TRANSATLANTIC TESTS SUCCEED!

The Atlantic Ocean has been bridged by the signals of American amateur stations—not one but dozens of them! Paul F. Godley, sent overseas with American equipment by the A.R.R.L., set up his station at Ardrossan, Scotland, and there copied the signals of the following stations:

SPARK

1ARY	Burlington, Vt.
1AAW	Illegal Station, not yet located
1BDT	Atlantic, Mass.
2BK	Yonkers, N.Y.
2DN	Yonkers, N.Y.
CAN.	3BP Newmarket, Ont.

C.W.

1RU	West Hartford, Conn.
1RZ	Ridgefield Conn.
1ARY	Burlington, Vt.
1BCG	Greenwich, Conn.
1BDT	Atlantic, Mass.
1BGF	Hartford, Conn.
1BKA	Glenbrook, Conn.
1XM	Cambridge, Mass.
1YK	Worcester, Mass.
2EH	Riverhead, N.Y.
2FD	New York City.
2FP	Brooklyn, N.Y.
2ARY	Brooklyn, N.Y.
2AJW	Babylon, N.Y.
2BML	Riverhead, N.Y.
3DH	Princeton, N.J.
3FB	Atlantic City, N.J.
8BU	Cleveland, Ohio.
8ACF	Washington, Pa.
8XV	Pittsburgh, Pa.

This accomplishment is epoch-making and opens the door to unguessed possibilities in private radio communication. We will publish the

COMPLETE STORY IN OUR NEXT ISSUE – DON'T MISS IT!

January 1922

20 Cents

H.B. HICK

WIRELESS TELEPHONE *broadcasting*

makes radio today more intensely interesting than ever before. We show on this page a complete receiving outfit, assembled from our comprehensive stocks. We recommend every item of this station without reservation, for both wireless telephone and telegraph reception. It consists of:

Westinghouse Tuner	**$65.00**
Westinghouse Detector and Two-Step Amplifier	**65.00**

(The Westinghouse RC set—a combination of these two instruments in one cabinet, is also offered for $125.00 complete.)

The Radio Magnavox	**$45.00**
Radiotron Detector tube	**5.00**
Radiotron Amplifier tubes	**6.50**
Radisco Better "B" Batteries,	**2.65**
Storage Battery, "Yale" 6-60	**18.00**
For weaker signals we recommend:	
Baldwin Phones, type "C"	**$12.00**
Baldwin Phones, type "E"	**13.00**
Western Electric Signal Corps Type Phone	**15.00**

Complete receiving station, exactly as shown above, including tubes, batteries, Magnavox, and Western Electric Phones, with instructions for operating, $236.00

Tell your friends who are starting in radio about Atlantic service both in the stores and by mail. They will thank you sincerely for recommending a house where you know they will be treated courteously and encouraged to continue their interest in radio.

"Bulletin 14" and special "Radio Broadcasting" literature gladly sent on request to the readers of QST and their friends.

ATLANTIC
RADIO CO. Inc.
727 BOYLSTON ST.
BOSTON MASS.
BRANCH
15 TEMPLE STREET
PORTLAND MAINE

RAC-3 AUDION

Price

AUDION

and

RECEPTACLE

$4.50

AUDIO FREQUENCY AMPLIFIER

RADIO FREQUENCY AMPLIFIER

AUDION OSCILLATOR

Full Size

FIRST UNIVERSAL AUDION

Manufactured under DeForest Patents No. 841,387 and No. 879,532

RADIO AUDION COMPANY

90 Oakland Avenue, Jersey City, New Jersey

No Radio outfit up to date without the RAC-3 Audion.
No need for buying "soft" or "hard" tubes.
RAC-3 Audions are interchangeable without necessitating critical readjustments.
RAC-3 Audions are not critical to A or B battery adjustments.
Low battery consumption. Filament current 0.8 amp. at 4 volts, maximum. Plate voltage 2 to 22 volts.
Clear signals and great sensitiveness on long distance reception.
Perfect oscillation for use in regenerative circuits.
Small size. Rigid construction. Non-microphonic. No tube noises due to mechanical vibration.
Maximum insulation between filament plate and grid terminals resulting from new type of tube and receptacle.
No soldered audion terminals.
Maximum direct mechanical contact between audion leads and receptacle clips.
Audion base caps and Receptacle block moulded Grade A Condensite.
Receptacle block is designed to permit built-up panel construction for amplifier panel. Circuit connections may be made from front, back or sides.
If your dealer is not carrying RAC-3 Audions in stock, send attached coupon.

Mail Order Coupon

Radio Audion Company,
90 Oakland Avenue, Jersey City, N. J.

Enter my order for.....RAC-3 Audions and.....Receptacles for shipment by return mail. Forward by Parcel Post insured. Enclosed herewith is Postal Money Order for $.....plus 10 cents for postage and insurance.

Name ..... **Address** .....

City ..... **State** .....

AIDS TO BETTER RADIO

DUBILIER C W CONDENSER

Type No. 580

Made in Single Capacities
0.001
0.002
0.005
0.01
0.02

Price - $4.00

Cat. #310 Triple Capacity
0.0003
0.0004
0.0005
5,000 volts
4 amperes

Price - $4.50

This latest addition to the already remarkably complete line of the Dubilier Condenser Company will meet a long-felt want of all amateurs interested in CW Transmission. The #580 condenser is extremely compact, is of rugged construction and the losses are infinitesimal.

The Pacent Universal Plug

Cat. #50, Price $2.00

No connections to solder. Essential for modern radio transmission and reception. Approved by the Navy Department. .Endorsed by foremost amateurs. .Supreme in its field. .Standard with many radio companies.

The Dubilier Universal Condenser

Type #577, Price $2.00

For transmission and reception. .Supplied in most used capacities from .01 to 0.0005 mfd. Especially designed for C.W. Will carry one ampere at 1,000 volts. .Standard with many radio companies.

DEALERS AND JOBBERS—You will be interested in our new proposition.
AMATEURS—Send five cents in stamps for Catalog Q1 describing "Pacent Radio Essentials".

Pacent Electric Company, Inc.

Louis Gerard Pacent, President
SOLE DISTRIBUTORS OF
Wicony's Complete Line of "Eventual" Apparatus.
Duo-Lateral Coils, Pacent Plugs, Seibt Condensers
Standard VT Batteries, Dubilier Condensers, Rawson Instruments.
Special Distributors of Brandes Phones
Special Distributors of Westinghouse Equipment.

150 Nassau Street, Telephone Beekman 5810 New York City

Price

TYPE 500
BAKELITE MOLDED
Variometer

$6.00

TYPE 501
WITH BAKELITE
DIAL AND KNOB
$7.00

OVER ALL HEIGHT 5¾"
STATOR WIDTH 3"
MAX. ROTOR DIA. 4"

There is a garantee with every Remler item

Electrically and Mechanically without equal

Remler *Quality* Throughout

Remler Type 500 Bakelite Molded Variometer $6.00
Remler Type 501 with No. 100 Bakelite Dial and Knob $7.00

Stator moulded in two halves from genuine Bakelite with primary winding moulded on the inside, insuring an absolutely rigid winding. Rotor also moulded from Bakelite. This all Bakelite moulded construction insures accurate mechanical dimensions, strength and precludes the possibility of warping or shrinkage. Large dimensions permit the use of low resistance windings. Maximum stator diameter 5¼"; maximum rotor diameter 4"; width across stator 3"; shaft 3/16" diameter. Bearings backed up with spring tension. Wave length range 175-500 meters. Stator drilled and tapped for panel mounting. Brackets for table mounting. Polished nickel binding post terminals.

Write for 32 page Remler Bulletin—just off the press.

REMLER RADIO MFG. CO.

E. T Cunningham, Gen. Mgr.

248 First Street
San Francisco, Calif.

154 West Lake Street
Chicago, Illinois

JUST OFF THE PRESS, AND UP-TO-THE-MINUTE!

Have you ever desired to assemble your own receiving set?

With diagrams such as those above, the construction is greatly simplified. These are but a sample of what is contained in our catalogue. No other similar publication is as full of detailed information. For instance, on page 38 we show the complete set of connections for the most sensitive receiving set known. Complete radio telephone circuits with the apparatus necessary for the assembly are indicated.

To prevent the Manual falling into the hands of those merely curious, we are obliged to make a charge of 25c for it.

You will receive a coupon receipt, which may be applied against future purchases of $5.00 or over. Write to 17 Park Place, New York, for WIRELESS MANUAL No. 13 H.

TO KEEP abreast with the rapid changes in radio apparatus, how many catalogues and booklets do you use?

We have just finished gathering together the latest developments in wireless equipment, and now offer you in *one book* the pick of the lines of the largest manufacturers, with descriptions and current prices.

To the amateur this manual is more than a catalogue. The first fifty pages are devoted entirely to a discussion of the subject and contain new and valuable diagrams of both transmitting and receiving sets. To the beginner is devoted a number of pages filled with information essential to a grasp of the science.

In the five retail Manhattan stores you will find the largest stock of radio material carried by any company in the country. If you can't come to them in person you will find efficient service through our Mail Order Department. Remember—

MANHATTAN Radio Headquarters

MANHATTAN ELECTRICAL SUPPLY CO. Inc.

MESCO A National Institution MESCO

New York City: 17 Park Place, 110 W. 42nd St., 127 W. 125th St.
St. Louis: 1106 Pine St. Chicago: 114 South Wells St.

©CIB520775

QST

The Official Organ of the A.R.R.L.

VOLUME V. JANUARY, 1922 No. 6

Transatlantic Tests Successful		7
2QR's Transatlantic Claim Disproved		8
Some Ideas on Short Wave C.W. Reception	*A. L. Groves*	9
"And It Came to Pass—"	*S. P. W.*	11
President-Governors Relay		12
Improving the Relay Spark Transmitter	*S. B. Young*	13
The Antenna System at 3DH	*D. W. Richardson*	15
Comments on the "Sure-Fire C.W. Circuit"	*H. S. Shaw, Jr.*	17
A New C.W. Record		19
Unnecessary QRM?	*"R.T.A."*	19
The Department of Commerce Cup		20
Boy Scout Radio	*John F. Gray*	22
A Kink in Core Calculating	*F. M. Edwards*	24
Reception Without Aerial or Ground	*Wm. Leyh*	24
Editorials		25
With The Radiophone Folks		27
The Operating Department		31
Amateur Radio Stations—1AFV, 9HM, 3SM, 9AGP, 9ABL		48
With the Affiliated Clubs		52
"Strays"		54
Calls Heard		56
Radio Communications by the Amateurs		63

Q S T is published monthly by The American Radio R lay League, Inc., at Hartford, Conn. Kenneth B. Warner (Secretary, A.R.R.L.), Editor and Business Manager. Edwin C. Adams, Advertising Manager.
Subscription price in United States, Possessions, and Canada, $2.00 per year. Foreign, $2.50. Single Copies, 20 cents.
Entered as second-class matter May 29, 1919, at the post office of Hartford, Connecticut, under the Act of March 3, 1879.
Copyright, 1922, by The American Radio Relay League, Inc.
Title registered at United States Patent Office.
THE AMERICAN RADIO RELAY LEAGUE, Inc.
HARTFORD, CONN.

THE AMERICAN RADIO RELAY LEAGUE

"A national non-commercial organization of radio amateurs, bonded for the more effective relaying of friendly messages between their stations, for legislative protection, for orderly operating, and for the practical improvement of short-wave Radio Communication."

OFFICERS

President
HIRAM PERCY MAXIM
Hartford, Conn.

Vice President
CHAS. A. SERVICE, JR.
Bala, Pa.

Traffic Manager
F. H. SCHNELL
1045 Main St.,
Hartford, Conn.

Treasurer
A. A. HEBERT
Nutley, N. J.

Secretary
K. B. WARNER
Hartford, Conn.

DIRECTORS

A. E. BESSEY
Sunnyvale, Calif.

V. F. CAMP
Brightwaters, L. I.

J. M. CLAYTON
Little Rock, Ark.

F. M. CORLETT
Dallas, Tex.

S. KRUSE
Cambridge, Mass.

W. T. GRAVELY
Danville, Va.

F. P. HAMILTON
Indianapolis

A. A. HEBERT
Nutley, N. J.

HIRAM PERCY MAXIM
Hartford, Conn.

C. A. SERVICE, JR.
Bala, Pa.

REV. SEBASTIAN RUTH
Lacey, Wash.

C. H. STEWART
St. David's, Pa.

K. B. WARNER
Hartford, Conn.

M. B. WEST
Waukegan, Ill.

F. H. SCHNELL
Hartford, Conn

H. M. ANTHONY
Muncie, Ind.

OPERATING DEPARTMENT

ATLANTIC DIVISION
Manager
Chas. H. Stewart
St. David's, Pa.
Asst. Mgr., Northern Sec.
C. J. Goette
1624 Hamilton Ave.
Woodhaven, L. I.
Asst. Mgr., Southern Sec.
Edw. B. Duvall
3909 Cottage Ave.,
Baltimore, Md.

EAST GULF DIVISION
Manager
B. W. Benning
50 Whiteford St.,
Atlanta, Ga.
Assistant Manager
W. B. Pope
197 Dearing St.
Athens, Ga.

CENTRAL DIVISION
Manager
R. H. G. Mathews
6433 Ravenswood Ave.
Chicago
Assistant Manager
L. A. Pease
2256 W. 24th St.
Chicago

ALASKAN DIVISION
Manager
Roy Anderson, 7IT
P. O. Box 206
Ketchikan, Alaska.

WEST GULF DIVISION
Manager
Frank M. Corlett
1101 East Eighth St.
Dallas, Tex.

PACIFIC DIVISION
Manager
J. Vance Wise,
Walnut Grove, Cal.

ST. LAWRENCE DIVISION.
Manager
Albert J. Lorimer
243 Mackay St.
Montreal, Que.

ONTARIO DIVISION
Manager
A. H. Keith Russell
11 Pinewood Ave.,
Toronto, Ont.

DAKOTA DIVISION
Manager
Boyd Phelps
3344 First Ave., South
Minneapolis, Minn.

NEW ENGLAND DIVISION
Manager
Guy R. Entwistle
137 Sutherland Road,
Brookline, Mass

ROANOKE DIVISION
Manager
W. T. Gravely
854 Main St.,
Danville, Va.

DELTA DIVISION
Manager
John M. Clayton
1301 Welch St.,
Little Rock, Ark.
Assistant Manager
Hubert E. deBen
1044 City Park Ave.,
New Orleans

WINNIPEG DIVISION
Temporary Manager
Boyd Phelps
3344 First Ave., South
Minneapolis, Minn.

ROCKY MOUNTAIN DIV.
Manager
M. S. Andelin
Richfield, Utah

MIDWEST DIVISION
Manager
L. A. Benson
4942 Wiesehan Ave.
St. Louis.

NORTHWESTERN DIV.
Manager
Howard F. Mason
3335 33d Ave., So.,
Seattle, Wash.

ADVISORY TECHNICAL COMMITTEE

C. S. BALLANTINE
WM. C. BALLARD, Jr.
LEROY M. E. CLAUSING
FRANK CONRAD
LEO C. YOUNG
MINTON CRONKHITE
J. H. DELLINGER
C. L. FARRAND
PAUL F. GODLEY
L. A. HAZELTINE
C. D. TUSKA
R. H. G. MATHEWS
J. O. SMITH
S. KRUSE

Address General Correspondence to Executive Headquarters, Hartford, Conn.

FEB - 3 '22

QST

A Magazine Devoted Exclusively to the Radio Amateur

Transatlantic Tests Successful

OH, Mr. Printer, how many exclamation points have you got? Trot 'em all out, as we're going to need them badly, because WE GOT ACROSS!!!!!!

As we prepare the copy for this issue of QST our Transatlantic Tests are in progress and we have the highly gratifying news from Paul F. Godley, our special listener in Scotland, that the A.R.R.L. has spanned the Atlantic! For the first time in history the signals of United States and Canadian amateur stations have been heard across the ocean on schedule.

Mr. Philip R. Coursey, in charge of arrangements in Great Britain, radioed us on Dec. 13th as follows:

"Many your stations heard by British amateurs. Details later."

We are most impatiently awaiting receipt of Mr. Coursey's detailed report, the compilation of which necessarily will have to await the collection and examination of the individual logs from the British listeners. It is this phase of the tests in which we are particularly interested—we want the British amateurs, with their normal receiving apparatus, to hear our signals if they can, so that we may hope to move amateur traffic to them on schedule. We trust that Mr. Coursey's report will be received in time for our next issue.

Paul F. Godley, special representative of the A.R.R.L., with special American equipment, located his station at Ardrossan, a small fishing village some twenty miles to the west of Glasgow, Scotland, after experimenting with various locations, and there listened for our signals thruout the ten day period, reporting nightly via radiogram from MUU which was repeated on this side by WII. To date twenty-six stations have been reported by him, as listed on the cover of this issue—six sparks and twenty-two C.W. stations. These are mostly in the eastern part of the country, rather contrary to expectations, the westernmost one being in Cleveland, Ohio. There is but one Canadian reported, 3BP, Rogers of Newmarket, and on his spark at that, but Mr. Coursey's report may show more of our cousins in the Dominion.

Station 1BCG at Greenwich, Conn., was reported on two consecutive nights and indications are that it had the greatest signal strength of any heard. This station was especially erected for the tests and was jointly owned and operated by Messrs. Minton Cronkhite, E. H. Armstrong, George Burghard, John Grinan, Ernest Amy, and Walter Inman. In its testing it has been reported from the Pacific Coast and must have kicked up considerable of a rumpus. Encouraged by the report of their signals, these men attempted to transmit an actual message, and to their credit be it said that they succeeded in putting across the ocean the first private radiogram ever transmitted across this span by an amateur station. The message was transmitted on the night of Dec. 11th, and acknowledged by a cablegram to A.R.R.L. Headquarters by Godley, reporting its reception at 3 a.m. G.M.T. on the 12th. The message read as follows:

"Nr 1 NY ck 12 to Paul Godley, Ardrossan, Scotland. Hearty congratulations. Burghard Inman Grinan Armstrong Amy Cronkhite."

Thus not only have amateur signals been heard overseas in astounding number, but a coherent message has been put over by the same means.

This is all the news we can give you at this writing, fellows. We got over, as we said we would, and our A.R.R.L. did it. It opens the door to big things and the scientists of the world are of course gasping and marvelling that such small powers on such short wave lengths could cover such distances. It will take some weeks to get the official story of the Transatlantics in final form, as we must now await Godley's return and Coursey's detailed report, but we will present it just as quickly as possible. And there will be some more call letters in the British report, you bet!

2QR'S Transatlantic Claim Disproved

IT will be recollected by our readers that a year ago this fall wide publicity was given the account that the 100 watt (input) telephone set of Messrs. Hugh and Harold Robinson, at Keyport, N. J., had been heard in Scotland. Although the results of our Transatlantic Tests show that it is not altogether beyond belief that such powers can be heard on the other side, QST has never felt that the evidence submitted in the case of 2QR could be interpreted as definite proof of its accomplishment, and, it will be remembered, is the only one of the national radio magazines which refrained from an unquestioned acceptance of the report. Accordingly we have watched with interest the efforts of a committee of the Radio Club of America which for the past year has gradually been collecting data on this subject and whose work has just been completed. The matter is of all the more interest to us coming just at this time, as it clears the way for our own A.R.R.L. Transatlantic Records and gives conclusive proof that we are the first to cross the ocean on schedule.

The report of the R.C.A. Committee, announcing their findings, reads as follows:

December 7, 1921.

TO THE PRESIDENT OF THE RADIO CLUB OF AMERICA:—

On November 1st, 1920, there appeared in various issues of New York press, statements that radio station 2QR located at Keyport, N. J., and owned and operated by Mr. Hugh Robinson, had succeeded in transmitting speech and phonograph music to Aberdeen, Scotland. These articles were based on a letter received by Mr. Robinson from an amateur operator, Mr. George Benzie, of Aberdeen. In this letter, Mr. Benzie stated that he had succeeded in receiving two phonograph musical selections and the signature of station 2QR on October 6, 1920, at about 6 P.M. Greenwich Mean Time.

Following the appearance of these articles in the press, a Committee was appointed by the president to investigate the authenticity of the alleged transmission. During the course of this investigation, other letters were received by Mr. Robinson and by the Committee from Mr. Benzie and a collaborator, a Mr. James Miller, also of Aberdeen, claiming the reception of signals from station 2QR on subsequent occasions.

After an investigation lasting over a year and rendered difficult on account of the distances involved, the Committee obtained evidence which settles the point in issue. We have laid this evidence before Mr. Robinson with the result that he is now convinced that Messrs. Benzie and Miller are in error concerning their belief that they had received the signals of station 2QR. His letter to the Committee stating this fact is attached hereto.

Let us here state that we do not question but that the original letter of Mr. Benzie was given to the press by Mr. Robinson in good faith. We have no doubt on this point whatever. But we are unable to state on what basis the letters of Messrs. Benzie and Miller were written and in view of the fact that at the time they allege reception of the signals of 2QR, this station was not transmitting, we do not believe that their letters merit further serious comment.

We find that station 2QR was not heard in Scotland as reported.

Committee on Transatlantic Communication,
Radio Club of America.

(Signed:)
E. H. Armstrong, Chairman,
A. A. Hebert,
L. G. Pacent.

We enclose herewith 42 exhibits with a detailed consideration of the evidence.

The following is the text of the Robinson statement referred to in the Committee's report:

13 Walnut St.,
Keyport, N. J.
Dec. 5, 1921.

Committee of Investigation,
Radio Club of America.

After seeing the evidence which has been secured by the Committee of Investigation of the Radio Club of America regarding the alleged reception of our Radio Phone signals by Messrs. Benzie and Miller, of Aberdeen, Scotland, we are convinced that according to this evidence Messrs. Miller and Benzie were in error in believing that they heard our signals.

We are glad to make this statement to the Committee after going over the matter in detail with them in order to clear up and settle the matter conclusively.

(Signed:)
Hugh Robinson,
Harold H. Robinson.

It is needless for us to go into the matter to any great length as we believe the two letters will explain themselves and give A.R.R.L. members a very good idea of the situation. We are grateful to the Radio Club of America for cleaning up this matter in the interests of the game and we also know that the Messrs. Robinson are glad in the interests of accuracy to have the matter settled, and are to be complimented for the broad-minded position they have taken.

Some Ideas on Short Wave C. W. Reception

By A. L. Groves, 3BID

WHILE much has been said and can still be said about receiving sets of the variometer type, the average amateur has become so familiar with sets of this kind for short wave spark reception that he hardly realizes the advantages possessed by a well designed condenser set for the reception of C.W. signals. Not only are C.W. signals easier to pick up with a condenser set, but as the ratio of capacity to inductance in primary, secondary and plate circuits can be changed at will, adjustments can be made to suit any condition at will and signals are much easier to hold and amplify than with a variometer set. Also for C.W. reception it will be found beneficial to employ a certain amount of "feedback" by slightly coupling the plate circuit to the secondary and if the condenser set is well designed spark signals are received at practically the same audibility as with a variometer set, with the addition of somewhat greater selectivity than is possible with the latter. While for maximum signal strength from spark stations the variometer set may have a slight advantage over the condenser set, maximum signal strength is very seldom beneficial for actual work, and it will be found that the selection of the proper ratio of capacity and inductance in the condenser set will allow actual work through conditions that would be impossible with variometer sets of the best make.

To make a good condenser set, a panel about 14 inches high and 16 inches long is needed. Three variable condensers are required. One should be of either 43 or 67 plates for primary, another of 13 plates for secondary and the other of about 26 plates for plate. Each should be equipped with extension handles about five inches long which may be made from ½" diameter bakelite rods drilled at one end for condenser shaft and at other for a knob. Three Sears-Roebuck coupling plugs, one for primary and one for plate, and one stationary plug are required for the mounting.

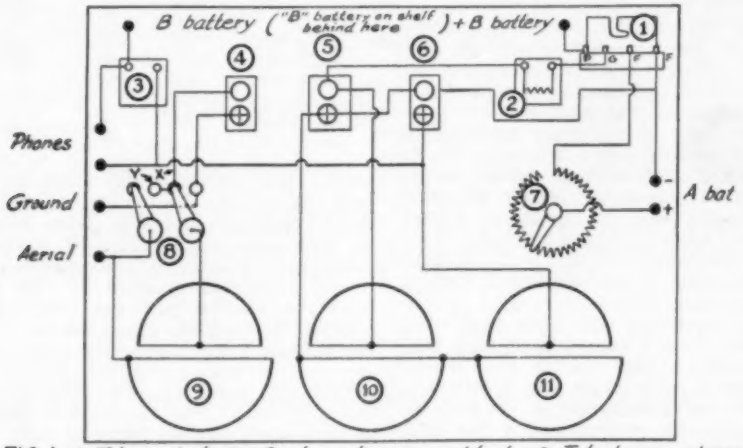


FIG. 1 1-Tube socket, 2-Grid condenser and leak, 3 Telephone condenser 4-Primary coil mounting, 5-Secondary coil mounting, 6-Plate coil mounting, 7-Rheostat 8 Series-parallel switches 9-Primary Cond 10-Sec Cond, 11 Plate Cond

These plugs are mounted 2 to 2¼ inches apart, the stationary plug being in the center.

Coils for use in this mounting for short waves may be wound on 3" outside diameter bakelite tubes. No. 22 D.C.C. wire is a good size to use and with the average amateur aerial six coils will usually do, to start with at least, for all waves between about 180 and 450 meters. These six coils should have 16, 20, 24, 28, 48, and 58 turns wound on them, the 48 and 58-turn coils being for use exclusively in the secondary and the others are for use in either primary or plate as required.

The 48-turn coil when used in secondary with a 13 plate condenser in shunt will have a minimum wave length of about 180 meters and may be used for waves as long as 300 meters. The 58-turn coil will have a minimum wave of about 200 meters when shunted with the same condenser and can be used on waves up to about 450 meters with fair efficiency, especially from C.W. stations. Coils with more turns of wire

may be used in the secondary for longer waves, but smaller wire will have to be used owing to the length of cylinder required for large wire. A coil composed of about 80 turns of No. 28 or 30 S.C.C. or D.C.C. wire will be found well suited to such waves as are used by a large number of C.W. and phone stations or between about 325 and 450 meters. It will respond to wave lengths of over 600 meters but not at maximum efficiency. For waves of 600 meters and over honeycomb or duolateral coils are recommended unless the amateur desires to use larger diameter coils than the 3 inch. The coils should be mounted in the regular DeForest manner with plugs and bands, complete sets of which may be purchased from Sears-Roebuck along with the plugs.

The usual regenerative circuit should be employed, the arrangement shown in Fig. 1 being very efficient. All instruments are mounted on back of panel except tube-socket, panel plugs and switches.

That such a set offers many advantages over variometer sets for C.W. reception is well established and with it many stunts can be done to somewhat lessen interference and static and to produce higher amplification when desired. Under bad conditions especially, one Baldwin receiver and a single tube is recommended instead of the usual pair of receivers and amplifiers. One receiver will give somewhat louder signals than a pair and signals that are not more than just audible with a pair can be easily copied when one receiver is used. Such an arrangement of the receiver is especially recommended for daylight work, where signals at best are weak.

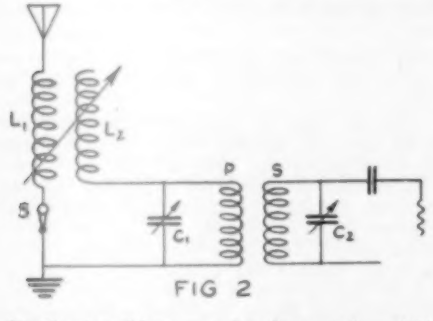


FIG 2

Static troubles can be lessened a little in receiving from C.W. stations by the simple process of shunting a resistance across the single Baldwin. Just why this is is hard to say, but a short trial will convince most anyone that the high flute note of the C.W. is not deadened in the same proportion as is static or low notes of spark stations. Under moderate static conditions a resistance of from 175 to 200 ohms shunted across the receiver has been found to work well while for heavy static as little as 10 or 15 ohms has been used successfully on amateur waves. There is also another thing in favor of the shunt and while it decreases signals considerably we all know that with even moderate strays signals below a certain audibility cannot be copied through it. Now if we cut in enough resistance to make these non-readable signals just audible or thereabouts we also cut down static to a like proportion and thereby cut out a lot of excess

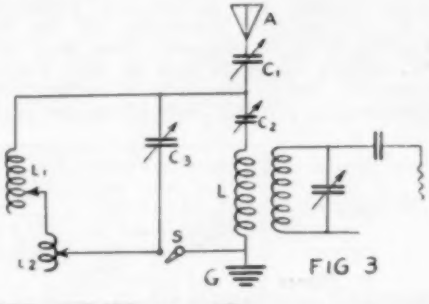


FIG 3

static that would only serve to tire one out and add to the confusion, which makes that much less noise to listen to in trying to pick out the signals. For instance, if prevailing strays have an audibility of 100 with occasional crashes of 200 audibility and the station you are copying has an audibility of 150, much easier copying is to be had by cutting in enough resistance to reduce the prevailing static to zero, which will leave an audibility of 50 for the signals and the occasional crashes and grinders will be deadened to such an extent by the shunt that they will offer less disturbance to the signals. This applies to both spark and C.W. signals but for C.W. signals especially I believe static is actually reduced to a greater extent than the signals. If not actually reduced, it apparently is so at least, owing to the deadening of static and the contrast in tone between static and signals.

Exceptionally large number of primary turns with primary condenser in series and at very low capacity also helps a little to reduce the ratio of static to signal strength, as does extremely loose coupling between primary and secondary and a corresponding reduction of secondary inductance and an increase of secondary capacity, and this is also more valuable in the reception of C.W. signals than spark signals.

Another scheme that has a tendency to reduce the static-to-signal ratio is shown in Fig. 2 where two inductances are placed in inductive relation to each other as shown at L_1 and L_2. The first inductance may or may not be connected to ground as conditions permit and a switch is therefore placed between it and the ground to disconnect it when desired. To the second inductance is connected the primary coil P

which is in turn connected to the ground and shunted by a variable condenser. The inductances L_1 and L_2 may be honeycomb coils of almost any size to suit varying conditions and it is not necessary to have both the same size.

While these are few of the more simple ways of decreasing strays, a little at least, it should be remembered that all of them necessarily decrease signals too, but the main idea is to get a better *ratio* of signal to static, which must be done at some decrease in signal strength.

Nothing can be gained by amplifying signals once they have been rectified by the detector as every increase in signals is accompanied by a corresponding increase in static. Long, low aerials give a greater ratio of signal strength to static than the higher aerials, but this applies more to long wave reception than to amateur waves.

In conclusion it may be well to mention the "trap" acceptor-rejector attachment which is particularly suited to condenser sets and affords the greatest selectivity known with a minimum reduction of signal strength and at the same time eliminates considerable static. The principle of this circuit is shown in the accompanying diagram, Fig. 3. A, C_1, C_2, L and G form the regular aerial-primary-ground system, the only difference being the use of two series condensers instead of the usual one. The trap is connected between the two series condensers and the ground and consists of a small inductance L_1 of low resistance and a still smaller inductance L_2 connected in series with L_1 for minute variations. These two inductances are shunted by a large-capacity condenser C_3.

In using this circuit the main object is to have a small value of C_2 and a large value of L_1 in comparison to a large capacity of C_3 and a small value of L_2. L_2 is simply a straight piece of copper ribbon 8 or 10 inches long with variable contact for minute adjustment of inductance. The tuning is first done with the switch S open and offers nothing unusual in tuning the regular regenerative circuit except selecting a small value of C_2. Then the switch is closed and C_2, L_1 and L_2 adjusted until signals again appear.

Such an arrangement may be easily added to the set described herein by connecting the condenser C_2 at a point in the lead X. The trap is then connected between point Y and the ground, and the set is operated with the switches 8 in series position as shown.

[An article on the acceptor-rejector circuit appeared on pp. 9 and 10 of QST for March, 1920.—Editor.]

"And It Came to Pass—"

In Which the Pride of the Family Learns Many Things

By S. P. W.

AND it came to pass that in the land of the Ninth District there was a young man, well-favored of the gods. And lo, in his nineteenth year he becometh interested in radio, and he saith unto his paternal parent, "Dad, I build me a radio set!" And his father rareth up in his wrath and rebuketh him, saying, "My son, knowest thou not that by so doing thou attractest the lightning, and mightest burn up the home of thy parents? That thou wilt receive shocks and keep thy mother in hysterics? Nay, nay, my son, of a surety thou shalt not have a wireless contraption in or on this shack!" And he picketh up his newspaper with a determined air.

But after the manner of youth in this age of iniquity the son at length prevaileth upon his parents, and lo, he ordereth many and divers catalogues which he peruseth avidly. He visiteth the homes of other amateurs whom he meeteth at the Radio Club, and he gazeth with awe upon their junk. In his heart he saith, "Not for mine! Radio is a great game, but I cannot afford all that!"

So he decideth that he will content his soul with a set of moderate power and range, and ordereth accordingly a mineral detector, yea, even galena, and a pair of phones. He buildeth his own loose-couplers, he filcheth a spark coil known to the ungodly as a Ford. He fashioneth a fixed spark gap, and a key of strap brass. He erecteth an aerial in the presence of all his neighbors, and they predict great calamity. He groundeth a wire on a gas pipe, and lo, the set is completed. And he rejoiceth exceedingly.

And when evening is come, he placeth on his head his receivers, and throweth a switch in order that he may receive. He adjusteth his detector with awkwardness, and delighteth in the static that he heareth, believing it to be signals. He tuneth with wobbly sliders and loose switches, to his utmost delight.

And it cometh to pass that in the fulness of time he heareth a man three blocks away, who hath a 1 KVA hooked in the closed circuit, and he crieth with a loud voice unto his folks, saying, "Here's Eiffel Tower!" for he aboundeth in imagination.

His folks marvel thereat and are delighted. His father telleth his friends the next day of the wonderful achievement, and proclaimeth his son a wonder, and a chip of the old block, and his mother readeth a paper at the Woman's Thanatopsis Club upon "The Marvels of Modern Radio" wherein she referreth to her offspring with much pride and many words, after the manner of women and mothers.

And the son taketh counsel with himself on this wise: "Yea bo, thou art wise in thy day and generation. Thou wilt not waste thy substance on expensive apparatus. Thou wilt be content to use the Ford coil, and the galena detector. Yea, verily!" Yet in his heart he knoweth that he thinketh not the truth, for in the hearing of his first message on his own set there riseth up in him a desire for more, and he squelcheth it not.

Time passeth, yea, even as it is expressed on the screen at the Temple of the Animated Reproductions, "A Year Elapses."

The son of his proud parents now sitteth himself down before a set that lighteth up the whole room with the glow of many audions, yea, even 'steen stages of amplification. He speaketh into a mouthpiece, and his voice carrieth even unto the far corners of the country. He hath a Round's Round Ground, and two aerials. He talketh of CW with an understanding voice, even if not mind, he argueth as to the practicability of the Colpitts circuit, he speaketh wisely of heterodynes and decrements, and he dreameth of new and more complicated hook-ups. He curseth darkly

when his Magnavox faileth to make IDO audible all over the block, and sweareth to get a real set if he be not reported QSA in Alaska.

His set waxeth more expensive daily. He hateth to cast up the multitude of shekels he hath spent on radio, yet he declareth unto all and sundry that it is worth it.

He readeth QST, and delighteth in the deep articles, and pondereth much thereon. He smileth in pity at young hams starting out with a hairpin detector and a copy of a certain brilliant colored radio magazine, yet he knoweth that they will gain understanding before many moons.

He feeleth himself to be wise beyond his years and argueth with everyone at the Radio Club. He maketh talks on "How to

Build a Sending Set for Two Hundred Dollars" and thinketh to himself what a pitiful sum that is.

He joineth the Boiled Owls, and sitteth up till the wee sma' hours to clear his hook. He longeth for the Wouff Hong of the Patriarch, or as he is called by the unregenerate, The Old Man, that he may smite the operators of the squeak boxes.

And he saith unto himself, "Lo, I have arrived! I am a regular ham." And he swelleth up with pride.

But the end it not yet!

President-Governors Relay

THE idea has occurred to us that it would be a mighty impressive stunt if we could get a message from the Governor of each state and relay those messages to President Harding and place them all in his hands on a given day.

Inquiries have shown that the above scheme appeals to the members of the A.R.R.L., and accordingly plans are being made for the event. Of course it will be a speed affair and messages will be positively flying through the air, probably causing QRM, and we must show what we can do under those circumstances.

Tentatively the scheme is this: Some amateur, who will be charged with the duty by his Division Manager, will secure from the Governor of his state a message addressed to President Harding. Each message coming from each state will start at a specified time, headed for Washington.

We will see which messages reach Washington with the greatest speed as determined from the time they are transmitted from the first station until they are received by a station in Washington. Some messages will have to be handled in a number of relays and it will take good snappy operators to put the messages through with speed.

Practically every station with any range at all will have a chance to show what it can do and you are earnestly requested to communicate with your Division Manager right now, telling him what you are capable of doing.

The dates will be March 6th, 7th, and 8th. The entire plan with all details will be given in February QST. Don't miss it!

Improving the Relay Spark Transmitter

By Sumner B. Young, 1AE

In Two Parts: Part 2

The next matter that needed attention was my aerial. The winter was unusually severe, and the halyards and sway guys needed constant watching. Finally it blew down in a gale early in March. It was replaced temporarily, but something stronger was needed, and as luck would have it, I met Mr. Bowden Washington, who suggested a cage. A four-wire cage eighteen inches in diameter and 55 feet long was built. Due to its compact construction, it was no longer necessary to use a lead-in. The cage was run directly to the ridgepole of the dormer window of the operating room, clearing all obstructions which would have bumped into a flat-top by a comfortable margin.

The natural period of this cage was nearly the same as that of the old flat top, and no appreciable increase in the reading of the hot wire ammeter was noted. However, it seemed to radiate more energy out into space, and I began to do more consistent work immediately. In "Concerning Cages", which was published in the October, 1920, issue of QST, a photograph of this cage and of larger type which was later erected will be found. Specifications of a cage well suited to amateur use are also given.

Still all was not plain sailing. On taking my condenser apart to replace a punctured plate, a few constructional faults were discovered. The photographic plates had not been properly cleaned before the tinfoil coatings were applied, and the connections to the tinfoil lugs where they were bunched together were open to criticism. The main objection was of a mechanical nature. The grouping of the plates was good. Two sections of twelve plates each were separated mechanically by wooden strips, and connected electrically in parallel before being taped together. This double section was connected in series with a similar unit of 24 plates, mechanically independent from the first. However, one whole section of twelve plates had to be discarded, for it was impossible to reach the punctured plate without breaking every intervening plate. The heat developed while the condenser was in operation had softened the shellac used to fasten the tinfoil to the plates, and the sheets of glass were stuck together hard and fast.

It was decided to build a new glass plate condenser of the same dimensions as the first, but a few refinements were to be instituted. Between every fourth plate two plain sheets of glass were to be interposed. These naturally could not stick together, and when trouble developed, four plates at the most need be discarded. Better mechanical and electrical connection to the tinfoil lugs was to be secured by clamping them between two metal plates drawn together by machine screws like the jaws of a vise—a scheme which had already proved efficient on other condensers I had made.

For want of time, this condenser was never built. The old condenser was temporarily repaired, and as I had been a thrifty individual before I became interested in wireless, I decided to try to escape from condenser troubles for good, and ordered a mica transmitting condenser of .007 mfd. capacity capable of handling a full K.W., at a maximum pressure of 25,000 volts.

The new condenser was installed on April 16th. Its capacity was lower than the glass plate condenser, as evidenced by the fact that a quarter of a turn more inductance was needed in the primary of the O.T. to bring the closed circuit into resonance. The spark was much snappier, however, and a coupling angle of 52 degrees gave the same H.W.A. indication that a 40 degree angle had given before. Slight increases in insulation, especially at the far end of the antenna, were needed, but I did this cheerfully, because it showed that more energy was actually finding its way into the aerial. The coupling was set at 52 degrees, I turned on the power, and called the first long distance station that I heard, which happened to be 8WY. He came back immediately, and I decided right

then and there that the new condenser was a good investment, and that a sharp wave had carrying powers which I had only half appreciated.

Due to the motor shortage, it was impossible to install an enclosed gap until this fall. A Fidelity variable speed motor was connected directly to a Benwood gap through a flexible leather disc coupling of standard design. A small doughnut-shaped ring fitted with a set screw was slipped over the shaft just outside the bearing on the gap, to prevent end play.

A spark frequency of eight hundred a second is maintained, using a 14 stud rotor. Another disc having ten studs was used at first, but the quenching action of the gap was so excellent that it proved possible to use the 14 point rotor and slow down the gap, thus placing less load on the motor and the bearings.

The coupling was done by an expert and there is very little vibration. However, the floor of the operating room, due to its dimensions, and to the small weight which is placed upon it, is sensitive to the slightest tremor. If a vibrating type magnetic rectifier is placed upon it, the hum cannot be heard outside the door of the room, but in the bedroom directly underneath a disagreeable noise is evident. The small residual vibration of the gap created some annoyance, so it was eliminated by putting four rubber balls which had outlived their usefulness in the squash courts under the wooden base of the gap. These made excellent shock-absorbers. The balls are thick-walled with a small air core, and they collapsed just enough under compression to "stand without hitching", and remained resilent enough to be very efficient.

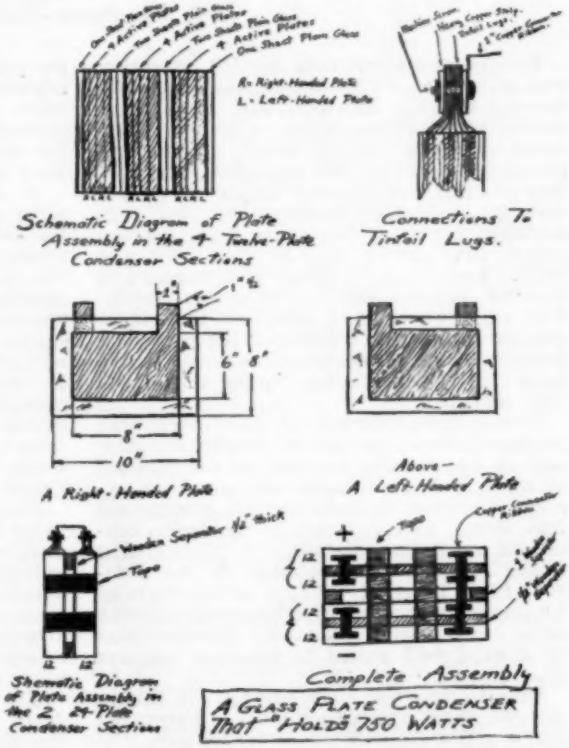
As a further refinement, the table was lightened by taking the transformer off the shelf and putting it on the floor, and to insulate the floor from mechanical shocks transmitted through the table legs, the latter were placed on little piles of excelsior.

The new transformer is a one K.W. Acme, tapped every quarter kilowatt. When it was installed, more insulation inside the operating room was needed. The lead-in bushing showed signs of leaking slightly in wet weather, so it was clamped into a piece of Bakelite six inches square.

The control of the set requires no special comment. When the changeover switch is in the sending position, the power leads to the trasformer are "made", and the rotary is started up. Power variations are effected by simply moving one wire to the proper binding post on the bus board of the transformer.

The set was tuned by setting the coupling at the working angle, 52 degrees, placing the clip on the loading coil at an arbitrary point, and bringing the closed circuit into resonance by means of the sliding contact on the O.T. The hot wire meter was used as an indicator, and the wave length was checked by 1CK's wavemeter at Braintree.

The power wiring has always been protected by a fuse block in the cellar, and by a mica condenser protective device connected directly across the primary terminals of the transformer. The ground post of the protective device is connected by means of a short copper ribbon to the main ground lead of the station. I have always believed in keeping the transformer two or three feet from the oscillating circuits, not so much as a precaution against kickbacks as to keep all foreign wiring out of the magnetic field around the O.T. The best protection against kickbacks is an adequate ground system. If your set is poorly grounded, the energy in the oscillating circuits cannot be properly dissipated, and it may run amuck and into the power company's lines. I have been told by Edison officials that poorly


R - Right-Handed Plate
L - Left-Handed Plate
Schematic Diagram of Plate Assembly in the 4 Tube-Plate Condenser Sections
Connections To Tinfoil Lugs.
A Right-Handed Plate
Above — A Left-Handed Plate
Wooden Separator ½" thick
Tape
Schematic Diagram of Plate Assembly in the 2 24-Plate Condenser Sections
Complete Assembly
A GLASS PLATE CONDENSER THAT HOLDS 750 WATTS

grounded amateur outfits have been known in extreme cases to cause the burning out of the company's underground cables, but they were talking me into installing separate power service at the time.

The ground system has recently been improved. The two tin roofs were connected by a ¾" copper ribbon, and the bottoms of two copper conductor pipes which led from the upper roof, and happened to have soldered joints, were connected to the lower roof with short lengths of copper ribbon. None of the conductor pipes leading from this lower roof to the ground had soldered joints, but the joints seemed fairly snug, and five of the conductor pipes were therefore grounded onto "crow-foot grounds". These were built out of small zinc plates, and were designed to give considerable surface in contact with the earth, and yet take up very little room, for they had to be buried in a narrow flower bed bordering the front piazza. Being directly underneath the spouts, the earth around them is always fairly moist, and in rainy weather little puddles of water collect beneath the pipes.

I have already admitted that my hot wire meter is a liar, and that it is not a thermo-coupled instrument. Furthermore, it runs up only to three amperes and is used only for tuning purposes, being shorted by a switch ordinarily. On the lowest tap of my transformer (which I suspect is nearer 300 than 250 watts), it runs slightly off the scale. This last addition to the ground system pushed the needle over a bit more. It increased the reading of the hot wire meter on my C.W. set by nearly two tenths of an ampere. To this day I don't know how much energy really finds its way into the cage when my spark set is in operation.

The O.T. has never been "doctored", even though it hasn't two inch ribbon on the primary and one inch on the secondary. The cross section of the turns is such that a *rounded* surface is presented to the high-frequency currents at the edges, where the current density is highest. A copper ribbon presents a sharp knife-like edge, of high resistance.

Receiving is a relatively simple matter. The ideal receiving set seems to be a short wave regenerative receiver, a soft detector tube, and two stages of audio-frequency amplification. Telephones of the mica diaphragm type have met with universal favor. More elaborate equipment is a waste of money. More stations will be heard, but nearby traffic will still drown them out enough to prevent traffic from being handled. Refinements in selectivity, such as vernier attachments on all controls, are becoming increasingly valuable, now that C.W. stations are more common.

If you build your own regenerative receiver, scrupulous care in every detail of construction will be time and effort well invested. Leads must be short and direct, every joint should be soldered, and switches must make positive contact.

The relative merits of various circuits are largely a matter of personal opinion. In general, you can do better work with a simple set whose peculiarities you have absolutely mastered than with a more elaborate set of instruments.

A certain wise saw, which I once heard quoted, runs like this: "Success lies in a healthy discontent with your surroundings and the will and energy to better them." Very true, but a man is bound to feel pretty blue at times when things go wrong, and a little encouragement may be helpful. My words of encouragement are these: it has always been my experience in wireless work that most problems could be solved by keeping one's eyes and ears open—which is something everybody can do.

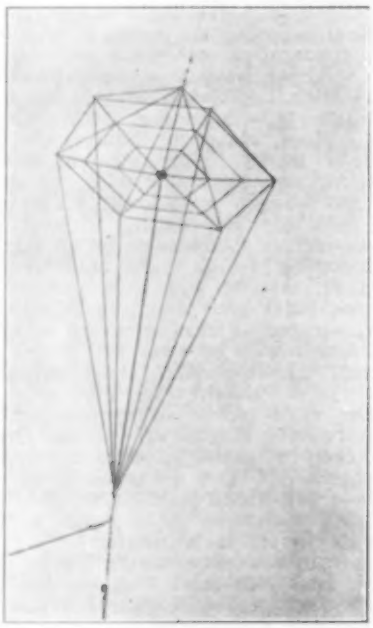
The Antenna System at 3DH

By D. W. Richardson

ALTHOUGH the antenna at 3DH is entirely a new experiment in a field that is not too well known to the owners of the station, the wonderful practical results which have arisen make us believe that our theory is correct in some points, if not in all.

The idea on which the antenna is constructed was outlined by the present author in a recent article entitled "Better Antennas". Since then, however the construction of a twenty-foot hoop has made it possible for this better type of antenna to be used, which the writer did not think practical at the time the former article was published. The theory upon which the antenna is built is as follows: an effort is made to have the energy as high in the antenna as possible; in other words, having the flow back to the earth, which takes place from the greatest capacity, as high as possible from the ground, and as near to the end of the antenna as possible. This is done by using a four and a half inch six-wire cage lead from the instruments to the antenna proper. Six wires were used throughout because of constructional convenience. This size cage allows an equal distribution of the current in each wire, and it also has the least resistance

for the least capacity, thereby making for the lowest wave length possible for any lead, and further allowing greater length to be used in the antenna without raising the wave. The antenna proper is a conical shaped cage, starting with a diameter



A Photograph of the Antenna

of four and a half inches and spreading to a diameter of twenty feet, and finally coming down to a point ten feet on the other side of the twenty foot hoop, the total length being forty feet. There are six wires in this conical cage, and the lead-in is taken from the small end. See Fig. 1.

The object of the cone, as was mentioned above, is to provide a large capacity at the far end of the antenna. This is why it is spread from four and a half inches to twenty feet. The purpose of using the six wire cage, as was also stated, is to get equal distribution of the current in each wire, whereas, if a flat top were used, approximately 60% of the energy would be found in the two outer wires.

Mr. R. V. Kuser, Jr., is responsible for the construction of the twenty foot hoop, which is a matter requiring no small skill, for the complete hoop weighs less than thirty pounds. It was made of six wooden strips ten feet long by one inch square, nailed radially from a round wooden piece, one inch thick and a foot in diameter, and the spaces between the strips filled with wooden sectors of the same thickness. On each side of this assembly was nailed a circular piece of wood, also one inch in thickness and a foot in diameter, the whole then forming a drum three inches thick and a foot in diameter. The legs of this spider-web affair were then braced with copper wire running around at diameters of ten, fifteen, and twenty feet, as shown in Fig. 2. These wires were connected into and made a part of the antenna system.

The construction of the counterpoise, illustrated in Fig. 3, is due to Mr. E. G. Sisson, Jr., and is a point upon which experimental data is somewhat lacking. The idea in building it was to present a surface of considerable area directly underneath the antenna. It is composed of eight wires, radiating from one corner of a rectangle ninety-five by sixty feet. All wires are joined at the far end of the rectangle. The height of the counterpoise is about fifty feet above the ground, and it is above the roof of the four-story building in which the set is located. In places the counterpoise runs directly over tin roofs ten feet beneath, and in others runs over a court fifty feet deep, so that the capacity between it and the ground is not uniform.

There are many other fine points in the construction of the antenna system. For instance, one inch rope was used throughout, and there is no iron cable or any conducting surface at all within seventy feet of the antenna, which is suspended on the

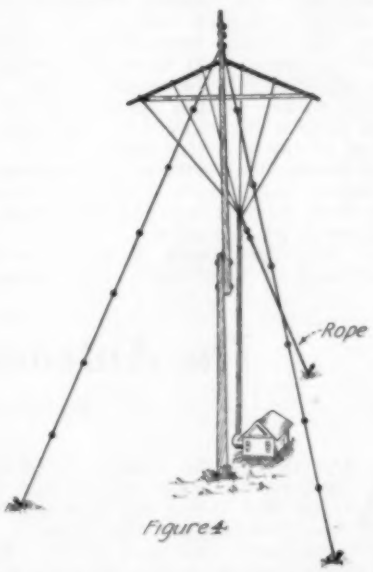
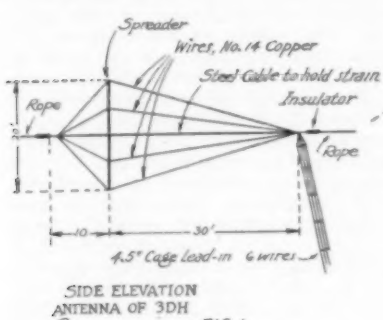


Figure 4

open end from a tower seventy feet away, and on the other end by a steel stack two hundred feet away. All the insulation is at the ends of the antenna and not in the separate wires. All wires are joined together at each end. The counterpoise is also thoroughly insulated and suspended by four insulators, one at each corner of the rectangle. The height of the antenna

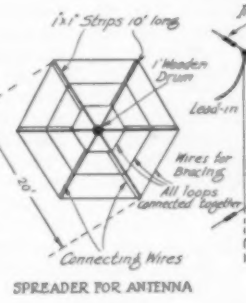
is 110 feet, or approximately sixty feet above the counterpoise. The actual resistance of the antenna is forty-two ohms; the radiation resistance is twelve ohms, and the fundamental wave length is one hundred and ninety-nine meters.

like this if he were building a station. It is merely what he believes to be the most practical type to be swung between two supports already existing. An experimenter, contemplating the construction of an antenna, is advised to put up one high



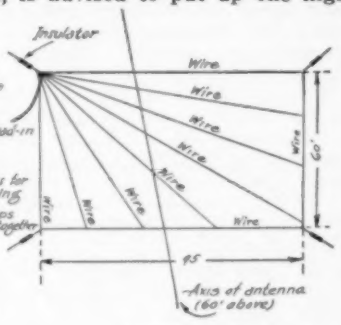
SIDE ELEVATION ANTENNA OF 3DH

FIG. 1



SPREADER FOR ANTENNA

FIG 2



COUNTERPOISE FIG. 3

Reports of the success of this type of antenna, using a single tube putting 250 watts in the antenna, seem to show a great improvement over the former type used at this station.

The writer would like to have it understood that this is by no means an ideal antenna, nor would he construct an antenna pole and to use a vertical fan-type like that shown in Fig. 4. It might, perhaps, be a good idea to substitute for the fan spreader two four-and-a-half-inch cages on the outside, running up to the thirty-foot spreader, and to leave out the inside wires entirely.

Comments on the "Sure-Fire C.W. Circuit"

By H. S. Shaw, jr., 1JK*

MR. Whittier's C.W. circuit, described on page 27 of the July 1921 issue of QST, has proved to be so popular and is in use in so many stations that it may be of interest to suggest the following modifications of it.

As a general rule we should try to keep as much of our apparatus as possible at ground potential, thus not only minimizing capacity effects and dielectric losses, but, which is perhaps of most importance to the experimenter, reducing the chances of getting unpleasant jolts when making adjustments and of burning out meters and doing other damage when parts of the circuit become accidentally grounded.

Fig. 1 is a simplified diagram showing the essentials of Mr. Whittier's circuit and it will be seen that the secondary of the filament transformer, the rheostat, the filament itself and the whole grid circuit, including the key, are at a potential difference with respect to ground equal to the generator voltage, viz. 350 volts or more, according to the type of transmitting tube used. Furthermore, if this circuit is used in a telephone set, with either grid modulation or a separate modulator tube, the secondary of the modulation transformer is also at the high potential, and since the primary of the transformer is connected

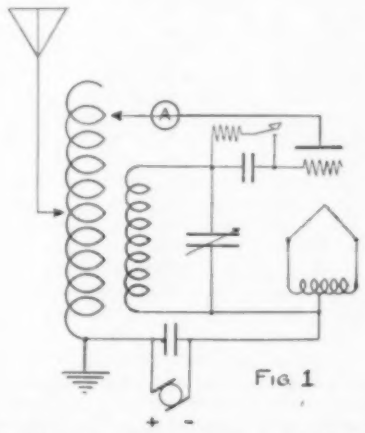


FIG. 1

to a battery (usually the one which lights the receiving tubes) and a microphone, both of which are, or should be, at ground potential, it is evident that there will be a

*Treasurer, General Radio Co.

difference of potential between the two windings equal to the generator voltage.

This is certainly an undesirable state of affairs, as explained above, and it may be avoided in a number of ways. Fig. 2 is an elementary diagram of a circuit which I have found satisfactory and which is not unlike Mr. Whittier's in principle. I shall not give a detailed description of the

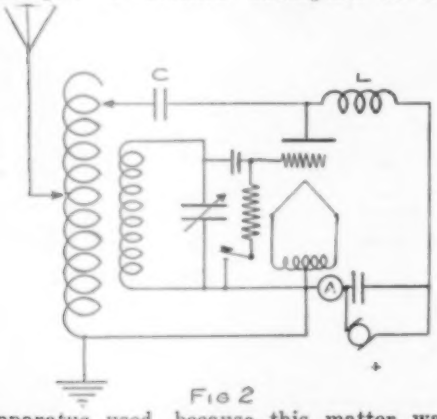


Fig 2

apparatus used, because this matter was fully covered by Mr. Whittier in his article. The high voltage supply is shown by the conventional symbol for a D.C. generator, but of course a rectifier or other source may be used instead.

It will be noted that the filament and the apparatus, connected to it, as well as the grid circuit and the plate-antenna inductance are all at ground potential. The high voltage parts of the set are reduced to a minimum, and do not have to be disturbed when making adjustments. The method of parallel power supply is used, in which the D.C. and radio frequency components of the plate current are separated out into two circuits. The D.C. path from filament to plate is through the plate ammeter "A", the generator, and the radio frequency choke "L", while the radio frequency path is through the plate inductance and the blocking condenser "C". This condenser serves to keep the generator voltage off the plate inductance and the antenna, and prevents the short-circuiting of the generator by the plate inductance, but it should be of low impedance to currents of radio frequency. A mica condenser capable of withstanding the generator voltage and of say .002 M.F. capacity or more should be satisfactory. Any good radio frequency choke may be used at "L", the requirements being merely low distributed capacity and sufficient inductance to prevent the short-circuiting effect on the plate inductance (for radio frequencies) which the generator and the modulator tube, if one is used, would otherwise have. Inductance of perhaps 2 or 3 millihenries will usually be enough for this choke, but it is best to try several different coils at this point, and note the effect on the antenna current. (A small honeycomb coil, shunted by an air variable condenser, and tuned to the working wave, will be found particularly satisfactory.—Ed.)

The grid coil is shunted by a variable condenser, as in Mr. Whittier's case, and it will usually be found that this tuned circuit aids materially in getting the set to oscillate at amateur wave lengths. It is also possible to tune the plate circuit instead, but this is generally less convenient because of the antenna and ground connections. The grid coil, if tuned, should be wound with fairly heavy wire, since the current through it may be quite large under some circumstances. If, however, the inductance of the coil is made such that only a small amount of capacity is required to tune it to the desired wave length, then the current through it should be very small.

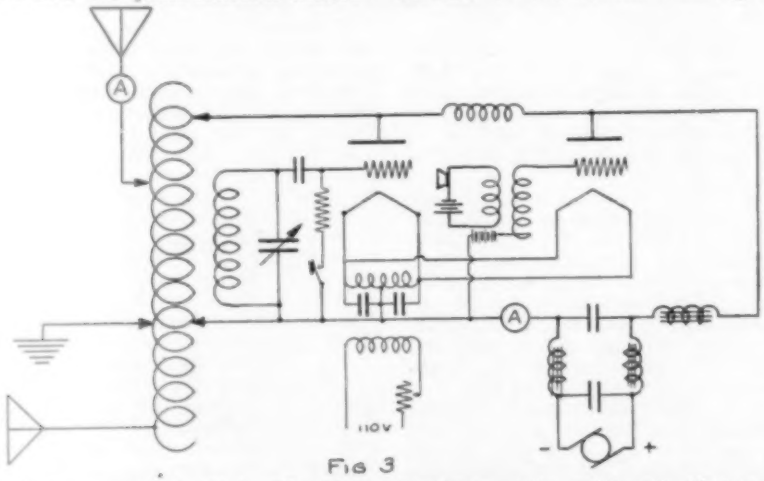


Fig 3

One other point may be mentioned, namely that the plate ammeter should be placed at the point "A", where it is not only at ground potential but is also not included in the radio frequency circuit. It is a wise precaution to shunt the meter with a switch which should be kept closed except when a reading is desired, thus protecting the meter from damage which is so likely to occur while adjustments are being made. The plate ammeter in Mr. Whittier's circuit is placed where not only the D.C. but also the radio frequency components of the plate current must pass through it, and this is not only unnecessary but is a disadvantage because the more apparatus we have in the high frequency circuits the more likely we are to get capacity and other undesirable effects.

No originality is claimed for the circuit described above it being my intention merely to call attenton to a hook-up which seems to me to be well adapted to the average amateur station. Fig. 3 is a complete diagram showing the application of this circuit to a telephone set with the Heising system of modulation. It will be noted that I have included the counterpoise and ground scheme described by Mr. H. H. Beverage in the November QST, and I can recommend this arrangement as being well worth while.

A New C.W. Record

IN the introduction to the Operating Department in November QST, the Traffic Manager was bold enough to prophesy that before this year had passed by, C.W. signals of less than 1 kilowatt would span the continent, or he would take up the entire Operating Department space in an endeavor to explain why it hadn't happened. Fortunately he is saved all of this and we will yet have space in QST for other things, for on the morning of November 23rd last, at 5:14 o'clock Eastern Time, station 1ES, operated by Robert E. Siskind, in Brookline, Mass., copied the signals of 6ALE, the station of W. W. Lindsay, Jr., in Reedley, Calif., while the latter was calling 9CP with 2.2 amperes in the antenna as the output of a single 50-watt Radiotron.

This we believe establishes two new records: 1st—as far as we know, it is the first time that a 6th District station has ever been heard in the 1st District; 2nd—it represents a new miles-per-watt record for the ever-increasing C.W., is the first time that the continent has ever been spanned by such a low power, and in our belief is the maximum distance that 50 watts of C.W. on 200 meters has ever covered, at least over land.

6ALE was described in detail in QST for December but since that description Mr. Lindsay has made certain changes. At the time of his record he was using a 5-watt tube as a master oscillator, supplying it with D.C. at 350 volts, the output of this being fed to the 50-watt tube which acted as a power amplifier using, however, alternating current on the anode. The wave length was 208 meters, the input to the anode circuit 100 watts, and the antenna current 2.2 amperes. 6ALE was calling 9CP on schedule from 2 to 2:30 a.m. Pacific Time and was copied for several minutes solid by 1ES. No elaborate receiver was used, Mr. Siskind's equipment consisting of a home-made single-tuned-circuit regenerator, a detector and one step using Marconi tubes, and Brown phones.

We congratulate both 6ALE and 1ES as being the respective terminals of our A.R.R.L.'s lowest power coast-to-coast transmission.

Unnecessary QRM?

An abstract from a recent radio phone conversation. Total time of conversation: 2 hours, 35 minutes. Intermissions: None. 9:20 P.M. until 11:55 P.M.

(The following represents approximately five minutes of the conversation) guaranteed genuine.

Submitted by the Radio Traffic Association. Brooklyn, N. Y.

Mr. A.—My set don't look so junky, ha ha, it's behind a table; have to crawl around with a match. Wait, I've got to think of something to say, it's hard to think of something to say, wait, I'll talk about transmission, it's something you can talk about all night without saying anything, ha ha, COME IN.

Mr. B.—Well say, old man, there is no use talking about nothing if there is nothing to talk about, but listen old top, about the transmission, the way I got R S last night was very good, sorry you won't be on tomorrow night, but I'll chew the rag with D G. Well heck, listen old man, I'll make a date, see, with you Monday night. I'll tune the set for you. I'll fix it so the folks can throw one switch and talk, that will be the Bees Knees, won't it? Answer please, answer please.

Mr. A.—Say that's fine dope OM, I say that is fine dope, yes that's fine, but make it 7:15 instead of 7 old man, listen, make it 7:15, yea, COME IN.

Mr. B.—OK old man, OK, all right. Say you put me in a nice pickle the other evening, I sed, you put me in a fine pickle, I sed Miss Feltman, somebody spilled the beans, you should have introduced her to me as Mrs. instead of Miss. Come in please. ANSWER.

Mr. A.—Ha ha, I forgot all about that OM, I say, I forgot all about that, yea, I forgot; well her husband was here, right here, and he said let me talk to that guy, ha ha ha, I want to apologize to you if I put you in an embarrassing position. I apologize, yea, 'm sorry, I apologize, will you accept it, COME IN, COME IN.

Mr. B.—Yea, sure OM, I did not mean it that way, I said I did not mean it that way, I didn't know, no, I didn't know, I don't think there is anything much to talk about we talk so much and often we don't leave enough time to think up anything to say. Besides I want to go down and get some shortcake, well I guess I will quit Old Man, I say, I am going to quit, COME IN, COME IN.

Mr. A.—O K old man, O K, I say, all OK, well there is one thing else I want to say before you quit, now what was it, wait a minute, wait, I'll think of it after a while, oh, now I remember, let's think up a plan to transmit parcels by radio so I can get some of that shortcake, ha ha ha ha, well I'll see you again old man, I say, I will see you again, yea, sure thing, well so long old top, so long. This is Mr. A, located at "Some Avenue", City, working with "Mr. B", working with station 2— —, I sed this was Mr. A (name spelled twice) yea, Mr. A, at "Some Avenue", Borough of - - - - - - - - working with station 2—, with station 2— Any cards from stations outside of New York telling us about how we come in there will be greatly appreciated. I say, it will be greatly appreciated Well, good night everybody, good night night everybody, I say, good night, G. N. G. N., ...—.— ...—.—

The Department of Commerce Cup

An announcemeent that will interest YOU. A cup to be given by Hon. Herbert Hoover to us amateurs. Be sure to read every word of this.

WE have the honor of announcing that Secretary of Commerce Herbert Hoover has offered a cup to be competed for by us amateurs annually during the present administration, under such conditions as the Board of Direction of the American Radio Relay League may lay down.

Mr. Hoover desires that the cup be awarded primarily for the best radio equipment in major degree constructed by the amateur himself. This is typical of Mr. Hoover, who is himself an engineer and realizes that the greatest benefits come to any line of endeavor when initiative and individual effort in design and construction are encouraged.

The most careful consideration has been given Mr. Hoover's invitation to prepare regulations for the annual award of a cup, and much thought has been devoted to the features which should be considered in determining the best equipment. Equipment of course is no good unless it works satisfactorily, so that, rather automatically, as we define the manner in which the award is to be made to the best equipment, we broaden out to something a little more than the idea one gets from the simple words "best equipment." Accordingly we wish formally to announce that the Department of Commerce's cups will be awarded annually under the auspices of the A.R.R.L., and in accordance with the regulations hereinafter appearing, to

AMERICA'S BEST ALL-AROUND AMATEUR STATION, *the major portion of which is home-made,*

as determined by a consideration of the following features:

(A) Extent to which the apparatus actually is made by the amateur himself.

(B) Ingenuity displayed in design, construction, and arrangement of the station.

(C) Over-all electrical efficiency of the transmitter, as determined by test or supported by acceptable affidavits.

(D) Consistent transmitting range thru the preceding year, as will be known to the Operating Department of the A.R.R.L. or determined by test.

(E) Performance of the receiving equipment, as evidenced by the station log or determined by test.

(F) Record of the station in obeying the Radio Communication Laws of the United States in every respect, and in complying with whatever local co-operative regulations are in effect in its community.

(G) The quality of the "sending" of the operator, particularly as regards "readability", brevity, and the quality of judgment displayed in operating.

(H) The amount of relay traffic handled in the preceding year, as will be known to the A.R.R.L. Operating Department.

(I) Accuracy, completeness, and neatness of the station's log. A log must be kept and submitted as an exhibit in this contest. It will be returned to the owner.

Regulations

The following regulations shall govern the contest and awards:

(1) Any licensed amateur radio station in the United States or its possessions shall be eligible.

(2) The particular idea of this contest being to encourage original design and construction by the amateur himself, the greatest consideration will be given to the extent to which the apparatus is "home-made", and stations in which the major portion of the apparatus is purchased ready-made will not be considered favorably.

(3) The calendar year shall be the basis for the annual awards. To be eligible for any year's award, a station must be in actual existence on December 31st of that year, and its operation during the preceding year will be considered primarily with a view to determining how good a station it actually is. There will be an award each year for four years, the presentation to be made by the Secretary of Commerce on March 1st to the successful entrant of the preceding year, except in the case of the first year, for which special regulations are provided in paragraph (7).

(4) To enter a station in this competition the entrant shall file the following material at the office of the American Radio Relay League in Hartford, Conn., not later than January 15th following the end of a calendar year (except in the case of the first award, for which special regulations are provided in paragraph 7):

(a) A manuscript containing a complete description of the station and its apparatus, particularly of those portions made by the amateur himself, and giving such data on features A to I hereinbefore referred to as will likely be of aid to the Judges in determining the merit of the station.

(b) The station log.

(c) Photographs of the transmitting equipment, receiving equipment, antenna equipment, and such other photographs particularly of home-made features of the station as will assist the Judges in determining the merit of the station.

(d) Wiring diagrams of the entire equipment, with constants.

(e) Sketches of any unusual equipment, if desirable.

(5) A Committee of Judges will be announced by the Board of Direction of the American Radio Relay League and shall take charge of the entries and determine the winner. Their decision shall be final.

(6) In determining awards, the Judges shall take into consideration the wave length and power allotted competing stations under their licenses.

(7) The first award shall be made for the calendar year 1921, even though no prior notice of competition was given. Especially for the purposes of this first award, entries will be received up to noon of March 1, 1922, and the award made as soon thereafter as possible.

(8) These regulations shall be subject to change up to Dec. 31, 1922, as regards the awards for 1923 and 1924; and up to Dec. 31, 1923, as regards the award for 1924.

We're off, men! We have been signally honored by our government and we are all going to do our best to show our appreciation. At this very minute the performance of our stations is counting in the determination of the 1922 award, but the important thing before us right now is to find America's best home-made station for the year 1921. Altho this is retroactive and no publicity has been given the matter beforehand, we do not want to wait a whole year before the cup is awarded the first time, and it really is not a difficult thing to undertake as we are at this writing just at the end of a calendar year, and of course the fact that notice of the award was not given a year ago is as fair to one as it is to another.

So we want entries, fellows! To start if off this first year they will be accepted up to March 1st but must relate to a station that operated in 1921. Remember that a rich man's station hasn't a ghost of a show in this competition—it is for the amateurs who build their own apparatus. Don't for a minute fear that because your stuff is home-made it can't compare with more expensive installations. Keep in mind that the idea of this contest is not merely to determine our "best" amateur station, but the all-around best station *in which most of the equipment is made by the amateur himself.* Mr. Hoover wants it that way, and we are glad of it. If you have a pretty good station in which you made most of the gear yourself, we want your entry. Carefully read the features that will count and the regulations, particularly paragraph 4 telling what should be submitted, and get up your material and mail it to the A.R.R.L. You have until March 1st to get it to us, but you'd better start right away, as these things have a habit of slipping a fellow's mind.

Who had the United States' best home-made amateur station in 1921? We all want to know. Come on with your entries and tell your neighbors that Secretary Hoover is going to give some one of us a cup because of just that. We guess our postman can carry a few more big envelopes each trip. As the old-time ad-writers used to say, DON'T DELAY—DO IT NOW!

Boy Scout Radio

By John F. Gray, 6MZ

The Boy Scouts of San Diego are to be congratulated on the splendid work they are doing, as told in this article. We wish that this account could come to the attention of Boy Scout organizations and educators everywhere, for it shows what can be done with a little initiative. If you are a Boy Scout, or interested in Scout work, why not present this idea to your local troop? It can succeed in your town as well as in San Diego.—Editor.

A RECENT issue of a national radio magazine contained some caustic comments on the wireless work of the Boy Scouts; the impression conveyed was that members of this organization were to be classed as hopeless hams and producers of QRM; in fact, the article ended with the appeal to all amateurs, "Don't be a Boy Scout". This is doubtless a condition in some cities, and the fault may lie, to certain extent, with the boys, but the local amateurs must be held at fault themselves for not giving more actual help and less criticism.

In San Diego, California, some amateurs, headed by Dr. A. E. Banks (6ZB), have given their aid to Scout radio work, attaining results so successful that they should be of national interest. The Department of Radio Signalling of the San Diego Council has become, in a few months, one of the livest organizations of the kind in the entire country. There is a radio school with over a hundred students. As fine a restricted amateur station as money can buy is now under construction; it includes a transmitting panel worth five hundred dollars made and given to the Scouts by the Southern Electrical Company, a variometer regenerative set with two step amplifier purchased with funds raised by public subscription, a cage antenna on a hundred and twenty-five foot mast, and every other feature needed to keep up to such a standard. A standardized portable field set has been designed, and every troop in the country will eventually have constructed one for use on hikes and in the field.

The radio school should be of real interest to every amateur anxious to do away for all time with the untrained small boy and his ubiquitous spark coil. The course comprises complete instruction, from that for the absolute beginner, who does not know a letter of code, to the graduate first class scout operator, capable of receiving twelve words a minute, able to explain the operation of sending and receiving apparatus (including vacuum tubes), and thoroughly experienced in the tuning and maintanance of high-grade amateur stations.

Code instruction is divided into three classes, A, B, and C. C class is for absolute beginners, taught in small groups with a buzzer until they are capable of taking about four words a minute. In B class the students must have obtained telephones, for signals are now sent on a five hundred cycle generator, with the key in charge of a commercial operator. This group is divided into two sections, the first of which gives numbers and simple text up to ten words a minute. The second section is perfected to twelve words, with added instruction in Q signals and abbreviations. In A class, as at present arranged, messages are transmitted between a transformer set in the class room and a small spark-coil outfit a few hundred yards away. Of course, greatly reduced power is used, so that there shall be no interference with regular amateur stations. Here the scouts are first taught proper methods of calling and practical use of Q signals; then traffic instruction is given, each boy being required to clear a certain number of messages per day in standard A.R.R.L. form.

A course in theory accompanies the code practice. Elementary electricity is first given, after which comes simple radio theory, followed by hook-ups, audions, and, finally, a course in tuning so thorough that any graduate is safe to be trusted to assemble amateur transmitting apparatus with the assurance that he will never operate his set in violation of the law.

Not until a scout is a graduate first class operator is he permitted to apply for his amateur license, nor to transmit on apparatus which can be heard by other stations.

Licensed graduates are assigned in regular order as operators of the Headquarters station, 6VL. From here regular QSTs on scout matters are transmitted to all troops in the country, scout business is handled with other cities, and a twenty-four hour watch is maintained, when

needed, for communication with the field sets of troops on hikes or in camp.

These field sets, designed to be carried by one signal patrol of eight scouts, all first class operators, have already done some remarkable work, although the design is still to a certain extent experimental, and the highest state of efficiency has not been attained. The total weight of apparatus, batteries, mast, antenna and counterpoise is forty-five pounds, and the cost, when built by the boys themselves, as is intended, is within fifteen dollars.

The mast consists of six sections, 4′ 8″ by 1¼″ pine staffs, with iron ferrules on the ends. A screw eye is provided in the top section for connecting the antenna. The antenna is made up of three wires, each of three strands of #18 bare twisted together, and 40 feet long. The top of the antenna is hooked to the pole, while the bottoms are soldered to a ring which slips around the mast fourteen feet from the ground. Guy ropes lead from insulators fastened to the wires twenty-five feet from the mast head, the whole making up into an umbrella. When carried, the antenna is wound on a wooden drum 14″ in diameter.

On account of the difficulty of securing good grounds in the field, a counterpoise was adopted. This is a square of bronze window screening, 4′ by 4′, sewed to a piece of canvas. The ground wire is soldered to the counterpoise.

Source of power is four (or eight) dry cells, carried in a box which also holds the telephones, log-book, message blanks, pencils, and a few tools.

The instrument box is made of three ply wood, measuring 12″ x 14″ x 7″, and weighing fourteen pounds; the front hinges down to make an operating table, disclosing the panel, upon which are mounted the spark-gap, crystal detector, connections, and aerial switch. The transmitter consists of a Ford coil, a condenser of 5″ x 7″ photographic plates with eight sheets of 4″ x 6″ tin-foil, an oscillation transformer of No. 10 bare wire, and a Murdock fixed gap. The primary of the transformer has 2¼ turns, spaced on $\frac{5}{16}$″ centers, with outside diameter 7½″. The secondary has 14¼ turns and a diameter of 12″, giving a wave length of 185 meters. Coupling is one quarter inch.

As all sets are made to specifications, and have the same wave length, it was considered unnecessary to make the receiver adjustable. Accordingly, the loose coupler was made without taps, although the coupling feature was retained to minimize QRM from stations of higher wave length. The primary has 17 turns of No. 16 double cotton covered on a cardboard tube 4¼″ diameter; the secondary is 3¼″ diameter, wound solid for 2½″ with No. 30 double cotton covered. The loose coupler is mounted behind the panel, with coupling adjustment projecting through the front. Three pairs of telephone connections are provided. All connections are soldered, and the set can only be opened by the patrol leader, thus assuring that adjustments will be unchanged.

As each signal patrol completes its set, it is given a two days camp in the country for intensive training; the camp is always located in some inaccessible place, and no communication other than by radio is permitted. Headquarters being in the city of San Diego, it is usually necessary to enlist the services of the A.R.R.L. for relaying. Not only is the well-being of the camp assured by hourly reports throughout its entire duration, but the A.R.R.L., and amateur radio in general, are given some splendid publicity.

Upon the establishment of the first training camp, on October 16th, Governor Stephens of California sent a congratulatory message to the scouts; it was dated Sacramento 9.00 p.m., and delivered in San Diego at 10 on the same evening, the camp's field set being part of the relay chain. The field set received this message direct from 6JD at Los Angeles, a distance of 125 miles, although QSL had to be relayed from 6MZ, a 1 K.W. station. This was on a Saturday night, with the usual QRM, in addition to very bad receiving

THEY BELIEVE IN SIGNS

His neighbors haven't any idea what "it" is, but they are all sticking around to find out where he keeps "it." (No, this hasn't a darned thing to do with Boy Scouts—we just thought it was time we published a cartoon.—Ed.)

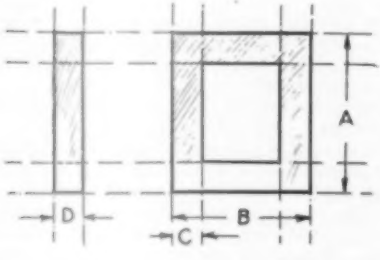
conditions, 6EJ in Santa Clara County notified 6JD that he had a rush message, but his first two attempts at transmission failed, owing to QRM and bad QSS. 6JD then sent a QST to all local amateurs to QRX and try to copy the message; the way all QRM ceased for nearly an hour till QSL was obtained speaks wonders for our A.R.R.L. organization out here. After nearly an hour's fighting of QSS the message was finally received by 6NY, Mr. John E. Bickel, of Whittier, some miles south of Los Angeles, who gave it to 6JD.

It is in work like this that the field sets give the scouts invaluable training. They have real traffic to handle, messages that are often on important business, and it has to be done right. At the same time, they are not tying up the air with useless hamming on 200 meters. We believe that a signal patrol of eight scouts means eight potential high class amateurs. When these boys have their own transformer stations, they will have nothing in operating routine and courtesy to learn; they will know it already, and be ready to fall in line with full-fledged league operators. The scouts are completely grounded in theory and practice of construction and operation in their radio school course; then they have the opportunity to work out all they have learned in the making and use of their field sets. When you learn radio like that, it sticks!

A Kink in Core Calculating

By F. M. Edwards

WITH the expanding use of C.W. many amateurs are getting into transformer construction who have never tackled this problem before. The writer in designing several transformers



evolved a formula which has proved very useful in quickly determining the number of cubic inches of iron in a core of given dimensions.

Referring to the diagram, let A represent the greater outside dimension of the core, and B the lesser; and C and D the cross-section, all in inches. The cubical content of iron may then be quickly found upon substitution of the values of the dimensions into the equation

$$\left.\begin{matrix}\text{Cu. in. of}\\ \text{iron in}\\ \text{core}\end{matrix}\right\} = [2\,C\ \ (A+B)\ \ -\ \ (2\,C)^2]\ \ D.$$

Reception Without Antenna or Ground

By Wm. Leyh, 2WM

IT may be of interest to the readers of QST to learn of a new field open for experimental work, that of receiving signals without antenna or ground. Just how it is accomplished and the benefit derived I will try to make clear in the following paragraphs.

After a great deal of experimenting with various types of apparatus, and under different conditions, I have succeeded in copying amateur, commercial and high powered, long wave stations with the everyday short wave regenerative receiver and detector two stage amplifier up to a distance of five hundred miles, which is by no means the limit, and I hope by publishing this for the benefit of the rest of the radio fraternity, the distance will be greatly improved upon in the near future.

The apparatus used in the test consisted of an ordinary short-wave regenerative receiver, wave length range 150 to 350 meters, and a detector and two-stage audio amplifier. The aerial and ground binding posts are left idle.

One of the important things that I discovered is that it works best *below the surface of the ground.* The deeper down the more QSA the signals. I started out by trying it at a height of 50 ft. above the ground, but with poor results, only nearby stations being recorded. As the height was cut down and the set approached the level of the ground signals increased rapidly in strength, the greatest signal strength being obtained below the surface of the ground.

In my case the depth was 10 ft. and with the above-mentioned set amateurs were copied a distance of 500 miles. In the basement below the ground therefore seems to be the best place for receiving apparatus, from my experience.

The only adjustments necessary are that the set be brought up to the proper point of regeneration by means of the variometers and then the coupling varied for finer tuning. Very critical adjustment is

(Concluded on page 47)

EDITORIALS
de AMERICAN RADIO RELAY LEAGUE

Excelsior!

RECENTLY an eminent radio engineer was telling us about how foolish we were to propose transmitting tests across the Atlantic. Not just in so many words but always in dizzy technical talk, the e.r.e assured us that "it couldn't be done." "Why," he explained, vest-pocket 'slip-stick' in hand, "the number of amperes that with a kilowatt input can be expected at the base of a 200-meter transmitting aerial of optimum effective height simply isn't capable of inducing the minimum required microvolts per centimeter of receiving aerial length to produce a signal of unit audibility at anything like that distance!"

Again we have witnessed such pessimism interrupted by somebody doing the particular impossible subject under discussion. We did not regard the outcome of our Transatlantics as absolutely certain as obviously a great deal depended upon favorable weather conditions, but we were certain that with decent atmospheric conditions we would get over. We amateurs are used to such things and are by now rather calloused to the cold unbelief of the scientific world in the mere possibility of our accomplishments. At that, tho, we were not prepared for the jolt we gave them with our Transatlantics—not only the scientific folks but the commercial companies. They had no idea it could be done—strong and steady signals night after night at a distance of three thousand miles, with an input of less than a kilowatt and the wave length two hundred meters! It was all contrary to the dope-sheet. They're wondering today why they put in 200-kilowatt machines and miles of 500-foot towers and use wave lengths of many thousands of meters when a private citizen in his home in Podunk, Penn., with less than 50 watts of C.W. power can do the same thing.

We only hope that our little international exhibition of how much better radiating efficiencies the higher frequencies have, will not excite the cupidity of some other interests. Such things are possible on two hundred meters only because of the hard work we amateurs have done in specializing our equipment for that work. The old-timers in our midst know that when 200 meters was assigned amateurs it was done to "get rid of them" and that nobody, even the amateurs, had any idea of successful work over any great distance on so short a wave. It took the battling of thousands of amateurs, and the love they bring to their work, to do it. We feel that we have earned and demonstrated our right to live undisturbed in our little world of 200 meters.

What next? We yearn for greener fields to conquer. We're sorry the 6's and 7's weren't heard in Britain and do not yet understand why they weren't. Maybe we can bite off a real big jump next time and send somebody to Japan. Hi!

The Herbert Hoover Cup

WE have had several fine things happen in our A.R.R.L. history, but none has surrounding it more of the "SPIRIT" we like to call our A.R.R.L. Spirit than the cup offered us by our Secretary of Commerce. The details are given in another column. We feel sure that every American Amateur will feel as we do when he reads them.

One of the pleasant elements in this offer of our Secretary of Commerce is the fact that Mr. Hoover is himself an engineer. We are, every one of us, engineers. We must need possess considerable mechanical, electrical and radio engineering skill in order to build and operate a radio station that will communicate over long distances on a wave length of 200 meters and a power input of less than one kilowatt. We like to feel that Mr. Hoover appreciates this. We believe he does and to a much greater extent than many of our government and military authorities who are not engineers.

And there is still another pleasant thought in this matter. It is that our time-honored and much respected "boss" is the Secretary of Commerce. Ever since there has been any control over Amateur Radio it has been administered by the Department of Commerce. Amateur Radio has grown from a few small boys to one of the great institutions of the land, under the wise and generous guidance of the Department of Commerce. The purchasing power of am-

ateurs has grown from a few hundred dollars a year to over five millions. Heaven knows what it will be next year and the year after, with the radiophone broadcast attracting the lay public the way it is.

Had it not been for the sympathy and encouragement and broadminded policy of the Department of Commerce and our own loyal organization, it might have been that we amateurs never would have developed in such a manner and in such numbers that we could do what we did for our country during the War. The Department of Commerce guided our faltering footsteps when we were young and helpless; and when we grew up and had our own organization and could walk alone, and the greatest war in the history of the world came, and our American Army and Navy found itself in direst need of radio operators, we amateurs were able to step in and save the situation. We cannot forget the Department of Commerce in this matter. Between it and ourselves a mighty good job was done, and under the stress of grim war. Like all teams which have weathered the storm together, a warm feeling exists one for the other, and this cup of Mr. Hoover's evidences it.

Every fellow in the A.R.R.L. will glow with pride, we are sure, because we are all of the A.R.R.L. and no one of us is more so than any other. It has been to our A.R.R.L. that Mr. Hoover and the Department have made this offer, and we say it is one of the fine things in our history. We hope it will be an annual classic for many years to come.

Traffic with England

NOW that it has been demonstrated that amateur signals can span the Atlantic on schedule we wish earnestly that our British cousins would get an appreciation of the fun to be had in relaying messages. We'd like to be able to accept English traffic and hand it over on schedule and we like to hope that some day they can answer us direct and two-way trans-ocean amateur communication may come into existence.

The thing that appeals to us American amateurs is the idea of talking back and forth. Many of us would never have stations just to listen in. And idle talking about one's signals and one's equipment soon palls—and right there is where the fun of relaying enters. When a newborn ham reaches the palling stage he is ready for the A.R.R.L. In the British Isles they have transmission of a sort now, general amateur licenses being limited to 10 watts, telephone working on 1000 meters (if only Unk Sam would stick our phones up there!) and other work on 180 meters. Now Great Britain is roughly 200 miles wide and 600 miles long and stations are getting pretty thick, so that power and wave length isn't at all bad; yet a well-known English amateur writes us that operation under such conditions is "worse than useless." Not a bit of it, O.M. We've got a crew over here who could hitch up a couple of bottles and install an American regenerator and give a cast-iron guarantee to work from one end of the islands to the other with the 10 watts of C.W. on 180 meters, the wonderful aerial regulations of your P. M. G. notwithstanding!

We cannot tell you, British Amateurs, how glad we are to learn that you have heard our signals. We congratulate you on your wonderful work and we thank you for your co-operation. You buckled down to that big job because it was there to be done and you were going to show us that you could do it. We would like to see this same spirit directed at this business of relaying!

We are filled with the hope that the Transatlantic demonstration will inspire British amateurs with the desire to participate in the benefits derived from relaying; that the British authorities, seeing the demonstrated possibilities of such communication and recognizing the potential value to their country of having such stations, such technical data as result, and such a corps of trained operators, will be minded to ease up on the restrictions now imposed on amateur work; and that under proper leadership there may come into being in the British Isles a traffic-handling organization similar to our A.R.R.L.; so that some day the amateurs of these two greatest English-speaking countries may clear their hooks each night of free citizen messages for the other country—radio hands across the sea!

C. W. and Spark

IT'S early to start drawing conclusions and we haven't any report as yet from the British listeners, but we must ask our readers to compare the number of C.W. stations copied by Mr. Godley in Scotland as against the Sparks. We understand this was done on a Super-Heterodyne receiver which of all equipment gives sparks the best advantage, thus accentuating the difference. Many of the C.W. stations were of ridiculously low power—some we know had less than fifty watts in the antenna.

To this add the recent over-land records of the C.W.—the continent spanned on fifty watts, for example—and it is evident that the advantage of C.W. transmission over Spark is absolutely over-

(Concluded on page 47)

With The Radiophone Folks

The Westinghouse Radio-Phone Service

The radio-phone concert and bulletin service of the Westinghouse Electric & Manufacturing Company is something new in the world. It is sent out to an audience scattered over a half a million square miles and is absolutely free to the public.

On the roof of the Company's plant in Newark, New Jersey, is a powerful wireless transmitting station. Down on the first floor is an attractive studio, equipped with various musical instruments and hung with curtains to make it sound-proof. In this studio, artists sing or play, and speakers deliver lectures or give out news bulletins. These messages are caught by a sensitive microphone, located in the studio, and sent by wires to the station on the roof. Here they are "broadcasted", going out through the ether in all directions at the rate of 186,000 miles a second.

The messages can be heard by anyone within a radius of 100 miles of Newark, though as a matter of fact, reports of their reception have come from Canada, Wisconsin, Florida, and 600 miles out at sea. The messages are heard clearly and distinctly, and the tone quality of the music is practically perfect. By the use of a sound magnifier, everyone in a room can enjoy the service.

The Westinghouse Company's program is of a high order and provides a great variety of entertainment. Every evening from 8:20 to 9:15, a concert is given at which well-known opera and concert stars frequently sing or play in person. At 8:00 P.M., a digest of the day's news is sent out by the Newark Sunday Call.

An especially popular feature is the "Man-in-the-Moon" fairy tales for children, written by Miss Josephine Lawrence of the Newark Sunday Call, and sent out Tuesdays and Fridays at 7:00 P.M. These stories delight the youngsters, and "Man-in-the-Moon" parties are now being given regularly all over the reception area. At many of these parties the children are ushered into a darkened room just before 7:00 P.M., and each is handed an earphone, connected with a receiving set. An illuminated moon lends atmosphere to the occasion. Suddenly out of the silence comes a voice—"Hello, children, are you listening? This is the Man-in-the-Moon talking. What do you suppose I saw today?"—and a wonder-story follows, interspersed with musical selections.

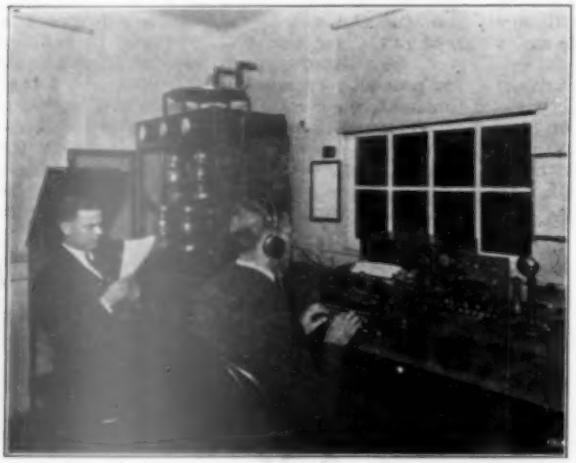
In addition, news bulletins are given out during the day, every hour on the hour; the official Government weather forecast is sent out three times a day; and the official Arlington time-signals are made available for amateur receivers at 10:00 P.M. Other features, such as election returns, bulletins of championship baseball and football games via direct telephone line from the fields, lectures by famous scientists, and so on, are given from time to time. These details are announced in advance over the radio-phone and are given in weekly programs issued by the company.

Artists' Studio, WJZ, Newark

All classes of people have welcomed this service, but none more than the farmers. They are now for the first time in instant touch with the rest of the world. They can obtain the news the moment it happens and can hear the best of music every night in their own living rooms.

The Newark station is located upon the roof of the Westinghouse factory building at Plane & Orange Streets, near the Lackawanna Railroad station in Newark. The antenna and counterpoise are supported between a steel stack which extends 114 feet above the roof level and a special 60-foot mast mounted on top of the building about 150 feet from the stack. The aerial consists of four wires equally spaced on 20-foot spreaders; the counterpoise is identical, but instead of swinging from the tops of the stack, and like the mast, it is

mounted about 20 feet above the roof. Thus the effective separation of the two sections forming the radiating system is about 94 feet at one end and 40 feet at the other, giving a net effective height of about 65 feet. Six-wire cage downleads run from both parts of the aerial to the radio station, which is in a special building on the roof, and are connected through double-throw



Interior of WJZ, Newark

grounding switches. The natural wave length of the antenna-counterpoise structure is not far from 500 meters, so that for transmission on 360 meters (the normal operating wave length for broadcasting) series condensers of 0.0005 microfarad are inserted in each connection. These are clearly shown directly below the lead-in insulators in the illustration of the interior of the station.

Two three-electrode vacuum tubes are used as oscillators for radio-phone transmission and three somewhat similar but specially designed high-impedance tubes modulate the radio frequency currents generated by the other pair. The antenna, counterpoise, grid and plate leads are all connected in the split-coil oscillation circuit to the flat spiral inductance illustrated on top of the radio set. This coil is made of flat copper strip mounted on micarta spokes, and is grounded at the minimum potential point nearly midway between antenna and counterpoise.

The oscillator and modulator tubes run on 2000 volts direct current, which is produced by a single-commutator generator driven by a direct-connected 2-phase 60-cycle, 5-H.P. motor. Special filter circuits are provided to suppress the commutator hum of this machine, with the result that outgoing speech and music is heard with very little extraneous noise from the dynamo. The filaments of the five large tubes are lighted by alternating current at 10 volts, this being drawn from a transformer; in this circuit again it has been found necessary to provide a grounded filter arrangement to eliminate the foreign noise of the 60-cycle alternating-current used.

The three modulator tubes are connected on the plate-modulation plan, and are supplied with voice-frequency current from a speech amplifier containing two three-element vacuum tubes. An ingenious arrangement compensates for the inherent distortion which is so often found when vacuum tube transmitters are operated at full power for radio telephony, and the clarity of the speech and music sent out from WJZ is limited only by the characteristics of the standard long-distance wire line microphone used to pick up the sound waves and transfer them in electrical form to the speech amplifier.

Not the least interesting feature of the station lies in the completeness with which its details have been worked out. The complete radio transmitter is enclosed in metal screening and glass, and a blower is provided to hold the tube temperature at the best operating value. A switchboard is mounted on the right-hand side of the transmitter so that the set may be connected to the station microphone for announcements, etc., to the shielded pick-up device used for phonograph reproductions, or to the studio which has been built on the first floor of the factory building.

This studio is specially designed for concert work. It is attractively furnished and is located where it is convenient of access to artists. A grand piano and other musical instruments form part of the equipment, and the walls are hung with heavy curtains in order to deaden echoes and cut out outside sounds. A variety of microphones is used for various kinds of work, such as solos, quartettes, lectures, etc. An interlocking system of light signals and switches connects this room with the transmission station on the roof.

The radio station is also equipped with a standard Westinghouse medium wave receiver, with a wave length range of 150 to 5000 meters wave length. After the nightly musical programme, which runs from 8:30 to 9:15 P.M., the 9:55-10:00 time signals from Arlington are received on this outfit, using a long single-wire antenna, and transfered electrically to the radio telephone transmitter. Thus the time-

signals themselves, with the characteristic spark tone of Arlington "NAA", are retransmitted on 360 wave length for the benefit of listeners having short-wave receivers. Obviously there is no appreciable time lag in this retransmission, and consequently accurate Naval Observatory time is made available in the amateur wave length range.

This station is one of a series of broadcasting stations established by the Westinghouse Company. Others are located at Pittsburgh, Pa. (KDKA, 330 meters), Springfield, Mass. (WBZ, 375 meters), and Chicago, Ill. (KYW, 360 meters). Additional stations will probably be opened in the near future. These stations grew out of the company's experience in building radio-phones for our airplanes in France, and form the first system to be operated on a continuous and regular schedule.

The new Westinghouse station at Chicago (KYW) operates during the grand opera season, which lasts for ten weeks starting November 10th, every night from 8:00 until 11:00 Central Time, except Friday and Sunday. Grand opera is also transmitted from 2:00 until 5:00 Saturday afternoon On Friday night, a phonograph concert is given from 8:00 until 9:00 P.M. Central Time. The station is operated at 360 meters wave length. The power is identical with the East Pittsburgh and Newark stations, i.e., the set consists of two 250-watt tubes as oscillators and three 250-watt tubes as modulators.

Rumor has it that the next Westinghouse phone stations to be erected will be at San Francisco and Dallas.

Absent Rotarians Addressed by Wireless

Rotarians assembled recently in more than fifty towns within a radius of one hundred miles of Pittsburgh, to listen to the speeches of the Rotary Club International Vice President, Ralph Cummings, and District Governor, Roy Neville, who addressed Pittsburgh rotarians in McCreery's Dining Room. They received the addresses by the aid of the wireless telephone, through arrangements made by the Westinghouse Electric & Manufacturing Company to broadcast the speeches through its radio station KDKA. In addition, many other people were able to hear the speeches of these prominent Rotarians. This was the first time in history that a meeting of this nature was received by other branches of the organization at different points, without the members attending the gathering in person.

Canadian Broadcasts

The Marconi Wireless Telegraph Co. of Canada, Ltd., operate phone broadcasting stations at Montreal and Toronto which put out news, market reports, musical entertainments, etc., every Tuesday from 8 p.m. to 9:30 p.m. on a wave length of 1200 meters. The power of these stations is ½ k.w. and their normal range 200 miles. A third station of identical characteristics is nearing completion at Halifax, N. S., but full arrangements for its operation have not yet been made.

Radio Recovers Another Auto

Another automobile was returned to its owner in late November thru radio. The machine was owned by a resident of Newton, Mass., stolen in front of his home, and was recovered the next night in Nashua, N. H., as the result of one of the regular broadcasts of the Boston Police Dept. from the station of the American Radio & Research Corpn. at Medford Hillside.

The machine was found abandoned in Nashua and the police notified. Upon looking over their list of police items received regularly for them by Henry E. Hall, a local amateur, they were able to identify the machine and return it to its owner.

Messrs. Doubleday-Hill Electric Co. announce the installation of a broadcasting radio phone at Pittsburgh with a range of about 700 miles, wave length 450 meters. Regular schedule will be announced soon.

On Nov. 20th Rabbi Louis Bernstein, of the Har Sinai Temple, Baltimore, delivered a "wireless sermon" to that city and environs via the radio station of C. Zamoiski, 3RM, under the auspices of the Maryland Radio Assn. The broadcast was a success in every way, the service with instrumental and vocal music being reported clearly received all over the city and suburbs.

Public Health Broadcasts

The facilities of Naval Radio Station NSF, Naval Air Station, Anacostia, D. C., whose signals are well known to wireless operators over the greater part of the country, have been placed at the disposal of the United States Public Health Service for the biweekly broadcasting of public health information. Thru the courtesy of the Chesapeake & Potomac Telephone Co., an agreement has been reached whereby that company permits its lines to be used for remote control of this radio station. It is therefore possible for the Public Health Service to broadcast talks, lectures, and other information directly from its offices or from any other point on the telephone system.

These broadcasts will be given out twice a week, on Tuesday at 4.15 p.m. Washington time, on 1100 meters, and on Friday at 9:00 p.m. Washington time, wave length 350 meters. The 4:15 p.m. schedules should have a range of 250 to 300 miles and the

9 p.m. schedules a range of 400 to 1500 miles, according to atmospheric conditions.

The inauguration of this service marks the first time in history that the radio telephone has been used for such purposes. Operators receiving these reports are requested to inform the Surgeon General of the United States, Washington, to that effect.

Concerning Ether Vibrations

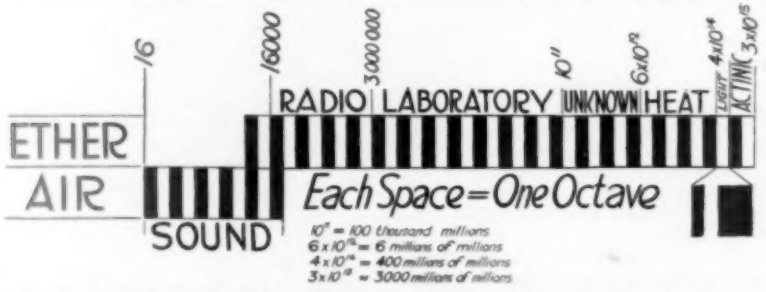
THE following excerpts from a lecture delivered recently by Lieut, E. W. Stone, U.S.N.R.F., before the Commonwealth Club of California, at San Francisco, will be helpful to students in gaining an idea of the relation obtaining between light, heat and radio waves.

"Communication by wireless is carried on by ether waves, and it is helpful in understanding these etheric or electromagnetic waves to consider waves on water, which are closely analogous. If we drop a rock into a pool of distilled water, there will be waves radiated in all directions from the center of the disturbance. These waves consist of crests and troughs —the crests, of course, constitute the top part of each wave, and the trough, the lower part between each two waves. We measure the length of such waves by taking the distance between the crest of one wave and the crest of the next succeeding one. This distance is, of course, the same as the distance between the troughs of any two successive waves, and this measurement is called the wave length. It is obvious that as we increase the number of waves radiated in any unit of time, say a second, they will be more closely crowded together, so that the wave length is decreased. The number of waves radiated per second is called the "frequency", and it is readily seen that as the frequency is increased, the wave length is reduced.

"Sound waves, which affect the ear, travel on a gas, a liquid or a solid, as their conducting media. The ear is only sensitive to sound waves of definite frequencies—from 16 to about 32,000. This range of frequencies is indicated on this chart, as shown, but the waves used in radio transmission travel on an entirely different medium, which pervades all space and which, for want of a better name, we term the "ether".

"In the 1880's, I believe it was 1883, an English physicist by the name of Maxwell, advanced the theory that light waves, as we commonly know them, are electromagnetic waves traveling on this mysterious ether—the difference in color in light waves being simply a difference in frequency or wave length. These light waves travel at a speed of 186,000 miles per second, or 7½ times the circumference of the earth. Wireless waves are exactly the same nature as light waves, and have the same velocity, so that if it were possible to build a sufficiently powerful station, we should be able to transmit a radio wave 7½ times around the earth in one second.

"Since Einstein published his now famous Principles of Relativity, there has been some doubt in the minds of scientists as to the necessity for our arbitrary conception of this almost fictitious ether. If Einstein is correct, there is very possibly no mysterious ether at all, but I hope you will not ask me any quqestions about his Theory of Relativity because I happen to be one of the unfortunate many who are not educated to the point of understanding the fourth dimension and theories of relativity.



"Just as the ear has certain frequency limits of sensitivity, so also will the eye respond to waves of given frequency only. The lowest frequency to which the eye will respond is about four hundred millions of millions per second, and electrical waves striking the retina of the eye at this frequency register the color red on the brain. The highest frequency to which the eye will respond is just about double this frequency, and at this rate of vibration, we sense the color violet.

"This band of colors indicated here, which you will recognize as the primary colors of the rainbow, range successively from red, orange, yellow, green, blue,

(Concluded on page 47)

The Operating Department

F. H. SCHNELL, Traffic Manager
1045 Main St., Hartford, Conn.

THE message traffic report will give you an idea of how traffic is being handled in the divisions. The individual honors for this month belong to the New England Division.

A. V. JOHNSON, 1DY
Lynn, Mass.
497 messages
New England Division

The outstanding piece of work for the month took place on October 23rd when 2AWL passed 23 messages to 8DE with a QTA on only three words. What makes this more interesting is that both stations used CW and it is claimed that at this time (between 7 and 8 p.m.) the spark would not have gotten through. 8AWP with 368 messages and 2BK with 378 did some mighty good work. But for the fact that the mast at 2OM came down, our message traffic would have reached a higher total.

Two new appointments were made during the past month. Mr. J. Vance Wise, Walnut Grove, California was appointed manager of the Pacific Division and Mr. Howard F. Mason, 3335 33rd Avenue South, Seattle, Washington, was appointed manager of the Northwestern Division. Both appointments were made after the amateurs in the respective divisions had cast their votes for the man they wanted to represent them as their division manager. The above two men received the majority of votes in their respective divisions, and therefore were appointed. We earnestly request each and every amateur in these two divisions to lend a hand and report regularly and promptly all message traffic (designating whether spark or CW) and general activity in his immediate locality.

Message Traffic Report by Divisions.

NOVEMBER

DIVISION	CW			SPARK			TOTAL				A.R.R.L.	Aver.
	Stns.	Msgs.	M.P.S.	Stns.	Msgs.	M.P.S.	Stns.	Msgs.	M.P.S.	%Tfc	Stns.	M.P.S.
Rocky Mtn.	0	0	0	9	574	64	9	574	64	.040	64	9.0
Delta	0	0	0	7	724	103	7	724	103	.051	88	8.2
E. Gulf	10	438	44	6	95	12	16	533	33	.037	78	6.8
W. Gulf	3	366	122	30	911	30	33	1277	39	.089	231	5.5
St. Law.	0	0	0	7	115	17	7	115	17	.008	21	5.5
Northwestern	0	0	0	16	620	39	16	620	39	.043	142	4.4
Central	33	786	24	61	3274	54	94	4060	43	.284	1011	4.0
Roanoke	5	482	96	3	80	27	8	562	70	.039	173	3.3
Ontario	4	240	60	3	92	31	7	332	49	.023	104	3.2
Dakota	4	34	9	9	118	13	13	152	12	.011	54	2.8
Midwest	5	149	30	13	752	51	18	901	50	.063	363	2.5
New Eng.	4	209	52	11	1090	99	15	1299	87	.090	644	2.0
Atlantic	23	1522	66	31	1650	53	54	3172	59	.221	1742	1.8
Winnipeg	1	5	5	1	2	2	2	7	5	.001	5	1.4
	92	4231	46	207	10097	49	299	14328	48		4719	3.0

Total spark messages, 10097 = 70.5%.
Total C.W. messages, 4231 = 29.5%.

Attention is called to the report of the East Gulf Division which Mr. Kruse calls the "CW Division", and rightfully it is the CW Division. The message traffic report makes that clear.

NEW ENGLAND DIVISION
G. R. Entwistle, Mgr.

Traffic handled in New England Division this month reached 1299 messages. The Springfield Traffic Convention brought us all together and succeeded in pointing out

our main difficulties. A.D.M. Robinson, 1CK, reports for his section increased activities with Johnson, 1DY, handling 497 msgs. during the month. 1ASF handled 90 messages, 1SN 94, 1RV 76, 1BJE 52, 1ZE 236.

F. C. Estey, 1AFV, of Salem, has installed a new 200-watt tube set in conjunction with his new 75-ft. mast and vertical antenna. 1ZE has rebuilt his antenna, adding 10 wires and now has 33 wires, 100 ft. long in the aerial. He has installed a 100-watt tube transmitter and completely junked the spark set. The antenna system at 1CK is out of order, having blown down during the storm, and traffic must take some other route for the present time.

1TS, A.D.M. Mix, reports considerable activity in his section. D.S. Nichols' station 1BM has been out most of the month owing to blown condenser and dislocated antenna. 1HO has been out of town but is back now and will handle his usual amount of traffic. Two new traffic stations have come to the front in the Southern Connecticut District. These are 1IV and 1AYQ who are both doing fine work. 1QN and 1AWB are both handling a considerable amount of traffic on CW. The station of the Springfield Radio Association, 1BWY, is in regular operation, and Springfield cannot be classed as a foreign country longer.

D.S. Randall, 1ANQ, reports radio in his district as very active. 1BRW, 1BGF, 1ANQ, 1ADP, and 1QP are handling about all the traffic thru the Hartford District. 1II at Wallingford helps out considerably with Southern Connecticut traffic. 1ADP, using ¼ kw spark in Tariffville, is clearing Springfield traffic, 1BRW is clearing same with addition of Western Massachusetts, 1BGF is clearing to the 2nd, 3rd and 8th districts. This plan of allotting the direction of traffic seems to be the most satisfactory arrangement. 1TS handled 92 msgs., 1AYQ, 60; 1QP, 30; 1ANQ, 27; 1BGF, 20; 1BRW, 12; 1ADP, 6; 1IV, 5; 1BM, 2.

A.D.M. Castner, 1UQ, reports marked improvement in the Northern Section. At Saco, 1BAS, is handling traffic for that region. 1UQ and 1AKY in Portland are both working phone sets. 1UQ has worked to the 8th district and 1AKY is QSA 100 miles on voice. 1FV is in full swing, doing excellent work with 1 KW transformer and sync. gap. 1ASW, 1BQL, 1OL, 1CCH, 1CIB, 1BLJ, 1UQ, and 1AKY are all on the job.

In Bath, Maine, 1ACO has succeeded in getting his set to percolate beautifully. He is now working fine DX, including 2's, 3's and 8's. 1UL is holding the same record and has a regular schedule with Canadian 9AK. 1APT and 1AHD are in on the activity, and 1CDO will soon have a CW outfit. Gardner, Maine, is coming to life and 1APO is in to complete the chain north, and 1BHR is also aiding the situation. At Rockland, 1AJJ is constructing a CW set and is soon to call a meeting of the Knox County Radio Club. Bangor has finally broken into the DX game and 1OT is reported and has worked many of the 2's, 3's and 8's. 1BIB and 1BLS have fine phone sets in Lewiston.

EAST GULF DIVISION

B. W. Benning, Mgr.

In this first report I want to thank the men of our East Gulf Division for the wonderful spirit of co-operation they have shown in helping us get the division lined up for relay routes. Everything is not running as smoothly as it should but we are confident that by next month we will be well on our way to the title of "the best and most efficient traffic-handling division in the U.S. and Canada."

The following appointments have been made by the Manager: M. F. Harrod, Box 467, Orlando, Fla., District Supt., State of Fla. V. C. McIlvaine, Box 12, Auburn, Ala., District Supt., State of Ala. W. B. Pope, 197 Dearing St., Athens, Ga., Assistant Division Manager.

The following appointments have been made by the Ass't Div. Mgr.: W. C. Etheridge, Woodruff, S. C., District Supt., State of S. C. G. L. Hight, Rome, Ga., District Supt., North Ga. Geo. P. Rankin, Jr., Macon, Ga., District Supt., Middle Ga. J. E. Hodge, Savannah, Ga., District Supt., South Ga. John Banks, Jr., La Grange, Ga., City Mgr. of La Grange.

Florida District: Mr. Harrod, a live wire of the 100,000 volt variety, has been after the men in his state since Nov 8th and has succeeded in digging up relay material that was unthought of before. In Jacksonville, M. D. Clark, 4BP, has been appointed City Mgr. and reports that 4ZE using C.W. has been clearing all the traffic thru the city. He will be assisted next month by 4BP and 4EZ using spark and 4AO using C.W. St. Petersburg: We have a fine prospect for a good C.W. station which is being constructed by Mr. E. R. Hall of that city. Clearwater: L. W. McClung has about completed his 250 watt C.W. set and expects to be in direct communication with all East Gulf stations with in the month. West Palm Beach: 4DL, 4DZ and 4AW are about ready to bust loose with good C.W. sets and will be the connecting link between Orlando and the Keys. No report this month from Miami. Key West: Manuel Fernandez, 4BO, has been appointed Dist. Mgr. of the Keys and will get Key West and vicinity in shape at once.

Alabama District: Supt. McIlvaine reports that much interest is being taken by the men in his state. Mobile: G. L. Barnett has been appointed City Mgr. and reports

that several stations are being constructed and that 5KB is at present in operation having handled 5 msgs. for the month. 5SL and 5JZ will be on the air in a few weeks and these three stations should be able to take west-bound traffic from Fla. stations and east-bound traffic from New Orleans stations. Montgomery: P. P. Brooks has been appointed City Mgr. and reports that prospects at present are not very encouraging. Mr. Carrie, our most promising prospect for a good C.W. station, is expecting to be transferred out of the city and is delaying the installation of his set. The Sidney Lanier High School is installing a good set but as usual with schools the progress is very slow. Several men say that they hear 5XA regularly in Montgomery.

Birmingham: Mr. Paul Jones has been appointed temporary City Mgr. but failed to make a report for the month. From other sources we are informed that the Birmingham bunch is only interested in seeing how much local QRM they can raise. 5XA is reported to be pounding thru regularly and should have no trouble in working Birmingham if they had just one good DX station there. Eastern Ala.: 5XA using a 500 cycle set on 250 meters and a low powered ICW set on 210 meters is handling practically all of the A.R.R.L. traffic for the state. They have a bunch of good operators there and are keeping a continuous watch every night. It has been reported that a station in Anniston is beginning to reach out and work DX but at present we have no data on this station. The call is 5ON we believe.

South Carolina District: Supt. Etheridge sends a very encouraging report for the month. He writes that S. C. has only a few stations, most of which are, as he expresses it, "wild and woolly". He cites an instance of a station he visited recently where the owner has a ½ KW transformer coupled to a condenser as big as a trunk, using an O.T. with 18 turns in the primary circuit, coupled to an antenna 140 feet long and 40 feet high without any sign of a series condenser. Hi! He states that it is his intention to take as much interest in the "other fellow's" set as he does in his own, and will make every effort to line up such stations as already exist in an endeavor to establish a relay route thru his section; or at least arrange for the forwarding from and reception of msgs. in his state. There are promises of two good stations in Spartanburg. Mr. Fred Boyter, chief electrician of a local plant, is building a set.

Greenwood: At least two good relay stations if the prospects are as good as they look. Greenville: There are a couple of CW stations here. There are two small stations in Anderson and Mr. Harry Wheat of Gaffney possesses some good equipment. To date no concerted efforts in making tests, etc., have been made but such work is promised in the early future.

North Ga. Dist.: Supt. Hight reports that 4BQ using spark and CW has been doing fine work this month. He carried out some successful tests on radio fone with Atlanta and Cedartown, both his voice and music being heard QSA at both places. He has worked up quite a bit of enthusiasm in Cedartown. Some promising material there in 4IJ and 4DA. He is now trying to arouse some enthusiasm in Cartersville and if he is successful we will soon have a "sure fire" route from Rome to Atlanta via Cartersville, Cedartown and Marietta. 4BQ says if you are blessed with "better halves" and "young squirts" you will certainly find the dove of peace more in evidence when using CW than in the "old days" when the 1 KW "coffin" was drawing 30 amps and discharging thru an 18 inch rotor in the open. (Hi—T.M.)

Middle Ga. District: Supt. Rankin has had no time to get a line on general conditions in his territory. Five stations are reported in Macon but so far only two have been able to accomplish any DX work. 4AS, Mr. Cargel's station, has a fine location and is developing into a fine relay station. Mr. Rankin's station, 4BK, has discarded his spark set and at present is handling traffic on CW. A good station is under construction in Columbus. 4BW and 4JH are in the DX class.

South Ga. District: Supt. Hodge sends us a good report as usual from Savannah but has had no time to get a line on the men in the rest of his territory. This month 4GL leads with 187 msgs. handled, with 4BY as a good second with 102. 4FF comes third with 20, and 4EL has 5. This is fine work for one city and we don't mind saying that if another city in Georgia would show the co-operation that the Savannah fellows show, we might be able to handle more traffic in our division. Nightly communication is held with Florida on CW and traffic can be promptly handled to and from that state. All spark traffic should be routed thru 4FD and 4GN in Midville, Ga. They are in a position to handle this work promptly. We have two records for our division that we are proud of and want to show them. 4GL was heard by a steamer in October 2450 miles northeast of Savannah and 4BY reported QSA on Nov. 16th by steamer 2800 miles from Savannah near the English Coast.

Midville: 4FD reports that conditions have been very poor for any good relay work thru his section. He has been coordinating reports of "low" and "high" pressure from the weather bureau with his Log of swinging and fading signals, no signals at all, etc., and finds that such weather has a very marked effect on radio signals. He finds that from those parts

of the country showing a low pressure (barometric) no signals come and as the area of low pressure moves across the country the QSS or absence of signals entirely is closely aligned with this low pressure territory. Msgs. handled, 21.

Lagrange: Mr. Banks, City Mgr., reports that he is the only man handling any traffic thru his city. He is at present using a high voltage "sink" gap set and has worked stations in all districts except 6th and 7th and has been heard in 30 states and Canada.

Athens: O.M. Pope reports that he has been so busy keeping the wolf from the door that he hasn't had time to do much work on his old rock crusher. However he has been able to sit down to the old set and tear off 16 msgs. in the last 5 or 6 days and promises to make 4GL and 4BY step some for first honors next month. (Don't make such rash statements, Pope, OM, the D.M. is using CW now and will have the old rock crusher on in a few weeks, so count him in on that first honor stuff.—B.W.B.) 4AG is arranging schedules with several eights and nines and it is believed that a great deal of traffic can be handled by long jumps thru 4AG in case he can find a reliable outlet thru 4YA, 4XC, 4FD, 4GN, 4BY or 4GL. A good spark route will be thru 4AG, 4FD and 4BP to Fla.

Atlanta: The D.M. has at last broken loose with a CW set and has, in one week, almost accomplished his life's ambition; i.e., he has worked 5XA, 4II and 4BQ. Just as soon as 4AG starts using the little bottles he will accomplish it completely. Never before has it been possible to work Fla. Ala., Rome, Ga. and Athens on spark. 4CO has been doing fine work on ten watts of CW and reports 19 msgs. for the month. 4XC has handled 26 msgs. since Nov. 18th (look out 4GL). There are about 30 stations in Atlanta but the majority of them seem to delight in raising local QRM rather than to take the trouble to tune their sets and join the DX ranks. 4AU has about completed his new spark set and will be heard in the air soon. 4CG has a good station but in a bum location and therefore does not do the consistent work that he should. 4ZF and 4FJ are still working on their stations and should be ready for operation soon. 4ZF expects to have a 500 watt CW set in about a month. 4CD, station of the Carter Electric Company, is putting out concerts every Sunday, Tuesday, and Thursday night at 7:00 P.M. Central Time. He will appreciate a report on his signals.

The "quiet hours" have been in effect for three weeks but the majority of the stations in our division are not observing them. Dig out your August issue of QST and post the schedule in your station. If you hear a station working during this period don't call him and tell him by radio—drop him a card and remind him of it.

ROANOKE DIVISION
W. T. Gravely, Mgr.

This month sees traffic moving throughout the entire division with regularity, and there are only a few points of importance which aren't represented. The North Carolina situation is clearing up in great shape. Charlotte is being heard from, Statesville is working, Salisbury is getting out, Greensboro is getting in fine shape, Winston-Salem is clearing traffic daily, as is Elizabeth City and New Bern, also Wilmington. The University of North Carolina at Chapel Hill will be in operation with a 100 watt tube set, and will prove very helpful to the A.R.R.L.

K. K. Kramer, Elizabeth City, D.S. Eastern Carolina, reports a great deal of activity, with 4EA, Parker, of New Bern, leading—38 stations worked and 13 msgs. handled. 4BX and 4BE, both of Wilmington, are reported out of the game this month. 4EY is reported as having transmitter troubles, but has been handling some traffic, and has, also, been clearing with Norfolk, Va., in the day time.

The Central Carolina District, under Mr. Bunker, 4CE, is on a spurt. 4CE is getting out with his tube signals, and is now trying out his "wings" so as to be able to get his bearings. Salisbury is in the air, and only recently, communication has been established between this point and Charlotte. 4GX of Greensboro is ready, and his signals are reaching out nicely.

The Western Carolina District under 4EN is showing up very satisfactorily. He reports day work with Statesville, N. C., 3BZ at Danville, and 3RF at Roanoke, Va., with fine possibilities in other directions. 4AL, 4CK and 4CX, spks., busy, as usual.

We are sorry to have to report the resignation of Blair, 3ZL, D.S. of the Central Virginia District. He has left Richmond, and will, in future, make his home at Wilmington, N. C., so he will still remain in the Division, and take up A.R.R.L. work in Wilmington. His successor has not been appointed yet. 3MO is handling most of the traffic with tube set, and reports 74 msgs. since the first of October. 3TJ is reported as having had gap and condenser troubles, and has been knocked out, temporarily. It is estimated that there are 150 amateurs in Richmond, and with that number, it is said there are very few "squeak boxes", which is a remarkable state of affairs. However, we understand that most of the fellows are interested in the tube method of transmission, and are experimenting with phone.

It is with regret that we report the death of Mr. Otis J. Thompson, who has been a keen amateur for many years.

White, 3EN, D.S. of the Norfolk District

says that the reason for the unusual silence in his section is that most of the station owners have been experimenting with radiophone, thereby letting DX work slide somewhat. 3ZZ has done splendid work with his ten watt tube set, and with the exception of XF-1, is about the only one who has done any real work.

Sgt. Blair of XF-1 informs us that, on Oct. 21st he and his assistants began actual amateur operations for the season, and since that time have handled approximately 230 messages. This station will be on every night from now on, and between Sgt. Blair and his worthy assistant, Private Geppel, things will hum. Lt. Whittaker, formerly Chief Operator at 4YA is now commissioned, and stationed at Fort Monroe, Va. 3XY, 3AB, 3EN, 3MK, 3ACT, and others are overhauling their stations, and experimenting with phone sets. 3ACE of Portsmouth is often heard with his spark set, and is doing fine work. He is clinging to the old spark in spite of the tubes. (How long?—T.M.) 3MK has done some splendid work on the Transatlantic preliminary Tests in receiving, having heard nearly all of them the first night. 3ACT is out of commission, temporarily. 3ACK and 3ACZ are very enthusiastic, and are very much interested in CW. Dr. Mercer of 3ATZ, Portsmouth is heard on the air, and works DX as consistently as his profession permits. 3EN is temporarily out of the game on account of a fallen mast.

J. F. Wohlford, 3CA, D.S. S.W. Va. District reports three stations working DX in Roanoke now, 3RF, 3BIY and 3CA, all CW stations. These are just beginning to handle traffic, and the way they are covering ground is most pleasing. Supt. Wohlford states that other stations are under way in his District too, and that many will be going before the next report is due. The Roanoke fellows want traffic, and they are going to get it. It is certainly fine the way this District is opening up.

D.S. Heck, through the Assistant D.S. E. C. Jones, reports considerable traffic going through West Virginia, the past month having been the heaviest in the past year. The outstanding development of the W. Va. field is the establishment of a good station at Charleston, 8BDB, which fills a much needed gap in lower W. Va., and makes possible a daylight route. The busiest stations in their order are as follows: 8SP, Fairmont, with 114 msgs. (F.B. O.M.) 8AFD, Clarksburg, 66 msgs. 8BUL, Morgantown, 8 msgs. 8BDB, Charleston, 6.

Traffic is traveling through Danville, Va. regularly, as usual, with 3AEV and 3BZ operating on CW. 3BZ has handled 51 msgs. during past month, and 3AEV has just begun.

In conclusion, we are giving XF-1's special report, which Sgt. Blair has so kindly sent the Manager. It is as follows—

"Total number of msgs. since Oct. 20th, 230. We handled one from 2ZL to 3ZY, addressed to President Harding, with about 100 words therein. Geppel has been doing most of the work, but I am on watch most every morning after 3AM. QSO with 5ZA has been established, and we sent one msg. to him direct. Am sorry that I won't be able to get 3½ KW phone below about 1200 meters, and on account of high fundamental of new aerial in new station may have to do all our amateur work on 450, with ½ KW. I WOULD LIKE TO HEAR FROM ANY OF THE DX MEN IN THE MDDLE WEST AND WEST who will be able to receive on the high wave (1200 or more), as I have great hopes for the big set. We will easily pass the 300 mark in traffic handled next month."

(All District Supts. Take Notice. In making station reports, please state total number of msgs. handled each month, the stations handling, and the number handled by spark, and the number by CW.)

ATLANTIC DIVISION
C. H. Stewart, Mgr.

Capitol District, F. H. Myers: 2FG is slowly rounding into shape. 2AWF is carrying the bulk of relay work in this district. This station has been doing some nice distance work and is a great help at present. 2XQ Union College Radio Club is getting under way. Nothing heard from 8HP although his signals were reported heard once or twice lately around New York City. Both 8AOT and 8TB of Johnstown and Gloversville are in operation and handling quite a number of messages for all directions. Station 2GK at Schenectady, has recently been opened and has been appointed official relay station for that city.

Western New York, Benzee Bros.: The amount of traffic handled in this district surely has taken a big jump since last report. 8AWP, Woodworth, City Manager of Syracuse, holds the record this month with a total of 368 messages, 362 of them being handled with CW. He reports that there are four CW stations in Syracuse that are always on the job. 8ADG of Utica has installed a 50 watt tube and is handling some traffic. City Manager Young of Elmira reports some traffic moving through there. 8HJ is again using his spark due to tubes burning out. Many reports are still lacking and although there is an increase in traffic handled it appears as though the fellows in general have not got down to brass tacks as yet.

Hudson Valley, Carl E. Trube: Traffic is moving regularly in increased quantity. Stations 2AR and 2OO are still out of commission, making 2DA the only station we have in Poughkeepsie. Communication

between 2DA and 2BM, Hudson, has been established and traffic is going through in good shape. 2DA reports handling 35 messages. 2UA has been moved to a more favorable location with prospects for better work. 2DK has been doing remarkable work with his rebuilt station. 2AID, 2OA and 2HJ are heard on occasionally but no reports. The Yonkers stations are going full blast, the ones doing noteworthy work are 2DN, 2AJE, 2BYS, 2BFZ and 2WP. Another new station, 2AAX of New Rochelle, has been on lately and certainly is putting traffic through to stations in the Fourth District in great shape with CW. Messages reported handled 2UA 16, 2AID 52, 2DN 163, 2AJE 110, and 2BK 378, total 754.

Long Island, Harry S. Collins: 2AJW has handled 93 messages this month, maintaining fairly good schedules with Jersey and Conn. stations. Consistent work is being done with stations 3BGT and 3BFU. 2EL handled 47 messages with both spark and CW. 2OE, who claims he never could get out of his back yard with a spark transmitter, has tried his luck with CW and now all his time is taken up answering postcards from the 4th, 5th, 8th and 9th Districts. Raymer certainly carries a smile these days. 2AWS has 31 messages to his credit, using spark. 2BRC has been heard with his CW but no report received. 2BML worked 60 stations—36 messages. 2BGR is still absent from the air.

Brooklyn—Frank A. Maher: Traffic in this district is about normal, the old reliable bunch 2WB, 2ARY, 2PF, 2DO, 2AMZ and a few others handling the bulk of it. No reports of messages handled during the past month received. 2UD with his 50 watt tube transmitter is doing wonderful work.

Southern New Jersey, Marcus Frye, Jr.: No report again this month.

Northern New Jersey, F. B. Ostman: A slight decrease in traffic work was noted during the past month. This seems to have been caused by the recent transatlantic preliminary tests. The great rush of new stations coming on the air has subsided and we know about how we stand. A general improvement of stations has been noted. The gaps left by the old timers leaving are being filled with new active material. The "Traffic Rules & Regulations" which have been adopted by the Second District Executive Council are being adhered to nicely throughout this section. It is requested that other districts discontinue their efforts to push DX traffic through to us during this local period and save their wind until we can take this traffic without restriction after 10:10 p.m. Many new appointments have been given to reliable stations throughout the northern section of New Jersey. A complete system of well equipped, capable traffic stations will be in operation for the peak of traffic work this winter.

Through the location of reliable stations in Newton, N. J., 3CG spk. and 3ARK C.W., both of which are worked regularly in daylight, traffic into Pennsylvania through the Delaware Water Gap, Stroudsburg and Scranton is now possible. 2OM maintains a schedule with these stations and will QSR any traffic for that direction. Improvements made at station 2DX now make it possible for Northern New Jersey stations to work traffic into Summit, Westfield, and Plainfield, a district seldom before worked from the northern section. 2OM reports the installation of a C.W. set using two or four 5 watt tubes to clear more traffic in conjunction with the old spark.

Each month it seems necessary to advise the different stations that the traffic

reports are due. The incentive to swell the total amount of traffic for your own District ought to be good enough to remind one of this matter. Your District Superintendent or local manager will appreciate these reports on time.

F. H. Canfield, 2ALY, City Manager of Newark, reports splendid co-operation from all stations, and a decided improvement in traffic conditions. A schedule of reliable stations to handle local and DX traffic has been arranged so each night Newark will have at least one good station on the job.

2AQU	C.W.	Monday night
2ABZ	C.W.	Tuesday night
2CL	Spk.	Wednesday night
2AML	Spk.	Thursday night
2ALY	Spk.	Friday night
2BDG	Spk.	Saturday night
2AQK	Spk.	Sunday night
2JW	Spk.	Substitute
2LT	Spk.	Substitute
2CCL	I.C.W.	Substitute

A.D.S. Johnson, 2AWL, reports traffic on the shore route moving at its usual consistency. 2WV is opening up for the winter at Deal, N. J. This shortens the distance between Long Branch and Asbury Park on the shore route. 2ASL is doing some fine work with his spark. 2KL is getting out on his C.W., being reported

advanced to 50 watt tubes and is getting the usual DX and noise that comes from those middle class bottles. If there are any amateurs in Freehold, Lakewood, South Amboy and Perth Amboy, who are desirous of doing relay work, please get in touch with 2AWL. There are several movements under way to form clubs in this section.

Traffic handled by following stations:—C.W.—2IA 20, 2AWL 161, 2ABU 6, 2AQU 14, 2ABZ 3, 2RU 27. Spark—2OM 390, 2ARB 25, 2AVR 12, 2OX 18, 2AUN 12, 2DR 30, 2UE 18, 2AIM 31, 2AQI 90, 2SQ 26, 2AML 5, 2ALY 38, 2BDG 30, 2ASL 35, 2ARS 6.

District Supt. for Western Pa. reports as follows: Station 8ACF, Washington, Pa., handled 202 messages. This station has done some excellent work and can always be depended upon. Station 8LX, Crafton, Pa., has handled 156 messages during the past month, using 20 watt CW set. 8QC, Grove City, Pa., reports clearing 12 messages, traffic being rather light during past month thru his particular point. However, holds a noon schedule with 8WY, Cambridge Springs, Pa. 8DV, Monaca, Pa., reports 18 messages but none from 8BJX, 8BHA, and 8ASB, stations in his immediate vicinity. Station 8WY, Cambridge Springs, Pa., using 10 watts CW, handled 38 messages. 8LF, Crafton, Pa., CW, cleared 56 messages this month experiencing great trouble in working stations 8WY and 8XE even though these stations cover good distances. 8AIO, East Pittsburgh, Pa., reports clearing 30 messages and also that his station is now complete and all construction finished for the winter. Having arranged several CW schedules 8AIO will no doubt handle considerable Pittsburgh traffic this winter. 8SE, Uniontown, Pa., using CW, reports 7 messages. The QRV Radio Asso. of Uniontown has taken care of the QRM question very nicely so that the air is clear after 10:00 P.M. and have arrangements where one station in the town will be on every night from 10:00 P.M. to 2:00 A.M. 8SE will be glad to arrange schedules with CW transmitting stations to carry on distance tests and relay work. Address communications to Box 1044, Uniontown, Pa. The District Superintendent wishes to call the attention to those not mentioned in this report that they must have their reports in on time or else they will be left out.

District Supt. for Central Pa., H. M. Walleze, reports that no radical change has occurred in his district. Conditions continue to improve, traffic moving fairly well. State College, 8XE, reports traffic moving steadily every night. Mr. Walleze has heard from Mr. Schoenburger at Pottsville, Pa., who intends to be operating shortly and Trunk Line "B" thru Penna. can then be realized.

Owing to heavy duty at college, Mr. Deichmann, District Superintendent of Eastern Maryland District, Baltimore, has had little time to make out a complete report for this month but has collected a little data on the work being done in and out of Baltimore and vicinity. 3AHK is reaching out exceptionally. 3EM owes most of his good work to the fact that his station has been operating after midnight until early morning, clearing most of his traffic over short distances after all other local stations shut down for the night. 3AC, spark, reports only 8 messages for the current month. 3CO, Falconer, an old timer, has been welcomed back and is on the job again. No reports have been received from either 3CO or 3DW. Little difficulty is experienced in working Washington now, with 3ZY to the rescue. Occasionally work is done with 3ABI, 3ALN, 3AFU and other CW stations in Washington, but no regular schedules have been arranged. Traffic to the north and west is steady and the distance between Baltimore and Philadelphia has been covered several times in the past month. It is hoped the condition between these cities will improve. Heretofore it has been hardly possible to route messages into Philadelphia direct. 3OU has been on the job as usual but makes a report of no messages handled. 3UC reports 8, and 3HG a total of 20 which is good for the little time he has to devote to the station. A total of 90 messages for the Baltimore stations is not so much for this time of the year. 3ZY reports 193 messages.

Eastern Pennsylvania — S. W. Place. Traffic Asst. Ehrhardt, of Dunmore, Pa., reports that 8ZQ is doing very good work on CW. 8ACS, now 8ZAB, formerly operated by D. G. Shotton, will be in working order this month and will be operated by the Traffic Asst. or under his supervision.

City Manager Fred G. Delong, of Reading, Pa. reports 21 messages handled. Has changed 3AIC transmitter from ¼ to 1 KW set (Reading H.S.) 3AHF has been appointed an official relay station on Branch No. 1 of trunk line B. Traffic Asst. P. C. Peterson of Folcroft, Pa. reports no one in Philadelphia is reaching out very far in DX work. He has handled 16 messages for last fiscal month. 3CE is out of the DX game and is working a small fone set. Is endeavoring to locate some good DX stns. in Philadelphia. Collegeville Radio Club reports 7 messages handled. Please be advised of the appointment of Guilliam Clamer, 3AIA, of Collegeville, as an official station. 3ZO has handled 48 messages. 3ZA reports 51. K. K. Keck, of Allentown, reports 10 msgs. handled. Traffic goes north and east via 3PU, south via 3GX and 3QW. The Dist.

Supt. is on the job again with CW and spark.

WEST GULF DIVISION
Frank M. Corlett, Mgr.

This month's reports are the most encouraging that I have received insofar as the division organization goes. We are getting some excellent live awake men in the Operating Department now, so just watch our smoke.

Appointments have been made as follows:

Robert L. Clinkscales, 5IE Asst. Div. Mgr., North Texas Section relieving Mr. Heafer. Mr. Clinkscale's address is 3913 Hamilton Ave., Dallas.

Currie Caldwell, 5MM, West 2nd Ave., Corsicana Texas, Dist. Supt. North Eastern Texas District.

Louis W. Hatry, 5KN, 2048 Fifth St., Port Arthur, Texas, Asst. Dist. Supt., South Eastern Texas District.

L. D. Wall, 216 Pereida St., San Antonio, Texas, Asst. Dist. Supt., South West Texas Dist.

G. D. Rayburn, 1134 W. Agarita St., San Antonio, Texas, City Mgr.

Sgt. Charles G. Clark, Ft. McIntosh, Larado, Texas, Asst. Dist. Supt.

Maurice L. Prescott, 5FO, 426 W. Eufaula St., Norman, Okla., Asst. Div. Mgr. Oklahoma Section. Mr. Prescott was selected to take charge of Oklahoma after much correspondence and numerous suggestions from various members throughout Oklahoma. A number of others were also suggested that would probably make as an efficient Asst. Div. Mgr. as Mr. Prescott, but those suggested were not members of the A.R.R.L. and of course could not be considered.

Reports of Sections follow:—

OKLAHOMA SECTION
Maurice L. Prescott, Asst. Div. Mgr.

Real radio weather is with us and almost all stations are doing good work. 5BM, C. M. Selby and his partner, will maintain a continuous watch from 7 P.M. until there is no more coming his way. 5LO at Miami continues to do good work, has handled 15 messages so far this month. Understand there is a new station going up at Vinita, Okla.; let us hear from you OM. 5HK and 5XI of Okla. City are in the air very QSA. Total messages North East Okla., 25. 5HK has been heard in 32 states this "season". 5XI is covering about 500 miles on a 10 watt fone set. Edmond, Okla., fellows are handicapped by not being able to use their set until after 10:30 P.M. on account of their City Council restricting the use of city current for radio until after that time. Same story, "flickering lights".

Now you Oklahoma fellows know that I can't make this Section without your help and co-operation. Each station report to your Dist. Supt. on the 15th of each month all the radio news and the traffic handled, if by spark or CW. Dist. Supts. get your reports in on time and make 'em snappy but containing all the traffic news. Come on now, let's see what Okla. can do.

NEW MEXICO SECTION
Louis Falconi, Asst. Div. Mgr.

Static has vanished and radio is once more possible in the southwest. Stations have been heard all summer but it was impossible to read a single word. With arrival of good weather traffic is once more pouring thru.

Traffic to El Paso still continues to be handled thru 5XJ, the station owned by R. W. Goddard, Prof. at New Mex. A. C.

A new station, 5OF, Clovis N. M. is being heard and reports working several stations east.

5ZA now has a 100 watt CW to take the place of the 20 watt set used last spring. A CW set is needed to overcome the bad QRM which makes long distance communication impossible and which in this part of the country is necessary in order to connect with the next relay station. In tests made with new CW set, 9XM, XF1, 2ZL, 7XF, 9ZY, 8ZG were worked with and reports indicate that sigs were heard in Fla., Conn., Vt., N.Y., Pa., etc. A regular schedule is being carried out with WJK at Taft, Cal., to which station a great deal of the western traffic goes. 6ZN also finds it easy to copy CW when the spark set is helpless.

Good stations are a great scarcity in New Mex. Owners of stations will please advise their Dist. Supt. so that relay routes may be worked out. Stations are needed in Albuquerqque, Sante Fe, Socorro and other places. Traffic received for those places must now be sent via mail.

At 5ZA, during the month, 316 msgs. were handled.

SOUTH TEXAS SECTION
Alfred P. Daniel, Asst. Div. Mgr.

Owing to splendid conditions, cool weather, and a peppy bunch of operators, this section is able to make a report entirely without the usual apologies.

The southern portion of the state has been subdivided into three districts, equally divided according to its amateur population rather than area. Mr. Ed. Nettleton at Eagle Pass is Dist. Supt. for the south WEST portion, and operates 5ZN at the extreme western boundary line. He announces three appointments in his district which will materially aid western traffic. Mr. Chas. G. Clark, of the Gate City Radio Club, is assistant Dist. Supt. for the Laredo, Territory. Mr. L. D. Wall, 5ZAE, is assistant Dist. Supt. for the San Antonio Territory, and Mr. G. D. Rayburn, of the Bexar County Radio Assn. has been selected as City Manager for San Antonio. Local traffic rules in San Antonio do not permit DX work between the hours of 7:15 P.M.

and 9:10 P.M. and it is requested that DX men not offer traffic to them between those hours. The active stations in the west, listed in the order of their traffic handling for the past thirty days, are: 5XI, 5ZAK, 5ZN, 5ZAE, 5ZR, 5QJ, 5MH, 5RR, 5MT, 5IL, 5HC—total of 251 messages for this district.

Mr. Wesley H. Tilley, 5ZU, at Austin, is District Supt. for south CENTRAL portion. He has not announced any appointments for his district, yet reports a busy flock of stations in his vicinity. 5RN has got 'em all stirred up over CW over there and father Tilley is thinking seriously of junking his famous spark. 5XU of the Texas University is doing most of the work for this district, having six operators. 5XU is reaching out in great style, with a 240 cycle 2 KW set, transmitting on 375 meters. A CW set of 2 KW is practically completed and will soon be in the air. 5YK is on the job day and nite, and one of the most dependable stations in this district. 5ZAG is operating regularly with both spark and CW, and gives phonograph concerts which are enjoyed. 5ZU announces that he will use a rotary interruptor in the antenna circuit to modulate the wave when calling, and will begin his CW activities with 50 watt tubes. Dependable traffic work is being accomplished between Austin and San Antonio, 5ZAK doing most of the work. Other stations in operation in Austin are 5QY and 5QA. No traffic report from this district.

H. E. Worthington, 5ZV, at Houston gives an interesting report for his south EAST portion of the state, of which he is District Supt., and requests correspondence from stations in this district which have not yet come under his observation.

Traffic was handicapped by the almost constant program of music, during the Houston Fair and Exposition but the following stations were in evidence at DX periods: 5XB, 5ZT, 5ZAA, 5NK, 5JI, 5LX, 5MS, 5CA, 5NN, 5PB, 5ET, 5JM, 5OP, handling a total of 533 messages. Mr. Warriner, 5TT, of Galveston opened up during the month, which has at last given us a terminus at the Gulf. His signals come in splendidly and communication has regularly been established. 5KN at Port Arthur is a growing prospect, and is heard not as often as we would like. Same can be said of 5RA at Cuero, and 5TG at Victoria. 5YI has been inoperative for quite a while due to the changing of its aerial system. Practically all of the representative stations in Houston are now using cage antennas.

NORTH TEXAS SECTION

Robert L. Clinkscales, Asst. Div. Mgr.

City Manager B. C. Gamble, 5JL, of Dallas reports the city activities are continually increasing. One can hardly imagine the amount of rebuilding of sets that has been going and is still going on. Static being dominant most of the time, and rebuilding of sets does not permit much DX work as there could be. We have been missing two good DX men, 5NC and 5JG. Suds Dorsa (5JG) is installing CW (Hi Schnell, a good man to educate into a CW hound) and expects to be on in the near future. Mansnerius, 5NC, is in trouble, and expects to be on in the near future. When QRN ceases a little bit more you are going to see Dallas show her form, and if we hear some guy say he can't pass traffic to Dallas, as has been said, he will be trying to do it at 12 P.M. instead of 12 A.M. The City Manager has divided the town into 5 districts to regulate traffic, and to see that the radio laws are complied with. The appointment of city officers will be made later.

A. L. Overstreet 5TH at Paris, Texas has installed a first class transmitting equipment.

The Waco Club has been reorganized. There has been shown a great deal of enthusiasm since reorganizatoin and are going to do some good work. Harris 5ZF has agreed to move his station to the club room. 5ZAF at Waco is handling the Intercollegiate Traffic between Baylor, A. & M., Rice, and State.

No report from Fort Worth District except messages handled. 5QI 81 messages, 5LC 13.

5ZAM reports two new and extremely well equipped stations being constructed there now, making four efficient relay stations for Commerce, Texas. There are 21 bugs at Commerce and are organizing a club and going to affiliate with the A.R.R.L. There is reported several new stations in this vicinity but no names given of owners, some in Sulphur Springs, Mt. Vernon, Mt. Pleasant, Allen and Celeste, Texas. The D.S. please get in touch with these stations if possible and advise A.D.S. as to the owners. 5ZAM leading station, 56 messages handled.

N. J. Rich, ex-9DYS, is opening up a new station at Idalou, Texas, another good opening through the Panhandle. Shake it up OM, and get started, good luck to you.

The appointments for D.S. are as follows: Northwest Texas District, J. S. Martin, (5IF) 604 E. 4th St., Amarillo, North Central Texas, Guy Neel, (5XJ) Dublin. North East Texas, Currie Caldwell, (5MM) West 2nd Ave., Corsicana. In making your reports to your respective D.S. do not forget to report the number of messages handled at your station. Just notice the report of the North Texas Section, the number of messages reported for the entire section should have been handled in Dallas alone. District Superintendents please report number messages handled by spark and C.W. separate. Number messages for

North Texas Section reported 391. 5QI leading station with 81 messages.

DELTA DIVISION
John M. Clayton, Mgr.

The Delta Division is in practically mid-winter form. Practically all of our stand-by stations are in operation and handling their portion of the traffic nightly.

DeBen, 5AA ex-5ZP at New Orleans, is reaching out *art* again on 200 meters and is handling his usual portion of the terminal business coming into New Orleans. New Orleans has several DX spark stations now, all of whom are reaching out a bit. 5AA still continues to be the best bet there, however.

5ZAB, the Pullens, at Houma, La. are doing some splendid work with the sink gap and "cootie" key. Possibly it's due to the gap, possibly to the key and POSSIBLY to the two good ops. there that they are handling traffic in FB style. We are inclined to hope that the operators have something to do with it.

5KC, Plaquemine, La., is a new comer but seems to have the "makings" and should develop into a real DX-er in a short time.

5ER and 5FV at Nashville, Tenn., are on the air now and then again, 5ER more regularly than before. Both of them are reaching OK and handling quite a bit of traffic.

5EK at Memphis, Tenn., is on the job every night and is developing into an old timer his first DX season. Is handling traffic OK now and raising considerable rumpus everywhere.

No report received from District Supt. Hutcheson of Wind Rock, Tenn. He is heard regularly both on CW and spark and is handling his share of the msgs.

Glad to hear our commercial friend Lehde of New Orleans, 5XQ, on the air now and then. He has one of the ½ KW Cutting and Washington coml. sets and raises some racket on 425 meters.

As things stand now traffic goes thru this division in about the following manner: Coming south it usually hits us around 5ER or 5FV and always from 9YM and goes down thru 5JD and 5ZL. If headed further south either 5ZAB or 5AA handle. Traffic going southwest for Texas goes either direct from 5JD and 5ZL into Texas or via New Orleans into Texas. The same is true of the western business except that practically all western traffic coming thru this way is put directly to 5ZA. Going north 9YM is the stand-bi for most of it, but when FN is not on the air the traffic goes thru any of the numerous 9's always on. Traffic for St. Louis usually wanders around over the country until someone gets hold of our St. Louis friends.

At Little Rock 5JD is plugging away every other night and doing the biz in fine style. JD been working the Canadian boys several times and is justly proud of the fact.

No District reports received from the D.S.'s of Louisiana, Tennessee, or Mississippi this month.

CENTRAL DIVISION
R. H. G. Mathews, Mgr.

During November we have been successful in getting considerably greater number of reports from the members of our traffic personnel but there are several districts which are not heard from and the amateurs in the locality covered by these officers who are not sending in their reports are not therefore getting the representation they should. We again want to urge every City Manager and official relay station to send in a report promptly on the 25th of each month to his District Superintendent, this report to include messages handled as well as items of local interest.

With fairly good weather throughout this month, message work has approached winter proportions. An excellent new trans-continental route has been opened up running west from 9ZN to 7ZO direct and from 7ZO to a number of Pacific Coast points. All our old routes are in working order together with many new ones, and traffic is being handled so effectively that nightly we hear stations asking for messages when there are none to be had, all the available traffic having already been forwarded.

K. A. Duerk, 8ZY, Supt. of Toledo District, reports 8ZY again on duty, with a second operator in Wm. Davison of 8FU. Asst. Supts. Kauffman and Preston report traffic gradually picking up, but little done as yet in forming branch routes as the fellows have not been on long enough to tell who will be reliable. 8OI at Elyria will make a good station and is on fairly regularly. 8AQZ has fine success east but not much west, so gives his WB tfc. to 8ZN. 8ZN can clear direct to Cleveland or thru 8OI. 8AJX, Delaware, is working on a CW set, which is beginning to reach out fine. 8AJE, also of Delaware, is doing good traffic work with his spark. Toledo is now taken care of by 8ZB on both CW and spark, and by 8BET, using a 50 watt tube. 8TK is again in on spark, and 8VJ reaches out very fine on CW. 8AFB in Mansfield is helping out with traffic, 8BEP also handling some occasionally.

Mr. & Mrs. Candler, Dist. Supts. of the Miami Valley District of Ohio, report traffic handling has been on a decided increase in this district. With no reports from Springfield and Xenia this month the number of messages reported is never-

theless, more than twice the number reported last month. This good showing is largely due to the excellent work 8FT at Troy who is again in full swing after an almost continual lay-off of about six months. Some of the Dayton stations have been out of commission at frequent intervals but are all getting back again. We have with us a new station, 8AHY at Middletown which promises well for a connecting link between the Ohio and Southern Indiana stations, working well with stations at Richmond, Ind. Columbus reports daily communication with Lancaster where a new station has just become fullfledged.

Summary of messages handled during the year, Nov. 1, 1921, to Nov. 13, 1921.

St. Mary's	1735
Troy	1355
Dayton	716
Middletown	37
Harrison	288
Cincinnati	601
Columbus	2807
Springfield	534
Xenia	44
	8117

Of the above total number about 200 were received too late to be reported to the Central Division Manager. There were also hundreds of other mesesages handled that were never reported to the District Superintendent.

In the District of Eastern Ohio I am sorry to say that we are losing our Dist. Supt., Mr. R. D. McCommon, who is forced to retire because of the pressure of other interests which are occupying much of his time. A successor has not yet been appointed and for this reason only scattered reports are available from this District for November. Our old friend R. F. Palmer, 8DE, writes us from Akron that he is through with radio forever. Palmer was recently married and has already left for Los Angeles, Cal., after disposing of all of his radio equipment. We wish Palmer all the happiness in the world and I know that if he decides to return to radio again, the west coast will find him a live wire.

F. F. Hamilton of 9ZJ, Dist. Supt. of Southern Indiana, reports that the Eastern Indiana traffic route from Fort Wayne to Louisville is coming along in good shape. Hamilton did not receive most of his reports until too late to get them to the Division Manager and consequently wants to impress upon the members of his personnel to get their reports in a little earlier.

W. R. Pierse of 9AWU, City Manager of Anderson, Ind., reports that the line from Fort Wayne is now a fact.

M. W. Hutchinson, Dist. Supt. of Northern Indiana reports increased activity in all parts of the district and interest has also been considerably revived.

The City Manager of South Bend has handed in a very complete report. The City Manager has been doing very good work on his new ten watt tube set having worked and handled traffic over five hundred miles. Many of the remaining amateurs in the city are beginners and so he has his hands full. The City Manager of Fort Wayne reports that he and 9II, (pre-war 9VY) who is now using a ten watt tube set, are the only ones who have done any work in the city during the last month. They are doing their best to hold up their end of it in Fort Wayne. More help, you other Fort Wayne stations. The City Manager of Angola is now on the job

SEND A MAP OF YOUR LOCALITY FOR REDRAWING AND PUBLICATION, TO QUX, 50 S. BALCH ST AKRON, OHIO

and doing good work. He reports that Hanes, 9DBQ, at Stroh is doing fine work on his new ten watt tube set. Note: All who have trouble getting messages to Chicago send them to 9DBQ and he will get them into the city. 9DON at Mongo is doing excellent work on his 32 volt Amrad outfit. He gets 150-200 miles with this set. 9AWZ at Hobart has been filling in the gap to Chicago and doing good work. 9AWZ is a much needed station and I hope he will keep up the good work.

C. E. Darr, 8ZZ, Dist. Supt. of Michigan, reports everything moving along nicely in his district—handling more traffic than ever. Michigan amateurs are planning on a convention to be held at Lansing about

February—big time is anticipated. CW is used almost exclusively in Detroit to handle traffic and is working out very well. 8ZZ, Detroit, has a 100 watt CW set and has worked with 5ZA at Roswell, N. Mex., and 1500 miles east of New York. At last the connection with the Canadian eastern line is complete and now our eastern traffic will be handled via Canada on short jumps—the thru eastern traffic is being handled successfully by CW. Connection via Detroit is easily made to Ohio stations, day or night.

Kentucky has been doing especially good work during November. J. A. Kolb, 9UH, reports new stations springing up all over the state and interest in radio things is on the increase.

B. A. Ott, of 9ZY, Dist. Supt. of Wisconsin, advises no reports from several good DX stations on number of messages handled nor did his assistant report any activities on the Lake Shore Route, the operation of which lies entirely in his hands.

Milwaukee City Manager reports things just at the point where a lot of hard work is necessary to line up for efficient relay work. The Milwaukee District is sufficiently organized to take care of any amount of traffic. The Lake Shore Route is still in a disorganized condition. We must open up this trunk line and get it going in good shape so that we will have another good route for Canadian Traffic. The Central Division needs this outlet for their Canadian messages. All the Canadian traffic at present must be sent through Chicago and Detroit. It seems unnecessary that Chicago with its many burdens should be required to take care of all this traffic that might be sent through other lanes.

The City Manager of Sheboygan reports not a message was handled during the entire month, either coming or going by anyone.

Nat. Smith, Asst. Dist. Supt. of Illinois, has been working hard on his District and endeavoring to reconstruct the old routes which were in operation last winter, but is getting very little co-operation from some of the City Managers and relay stations in his territory. Active stations in this vicinity are 9LQ, 9MC, (vy), 9YB, 9AP. CW seems to have attracted everyone's attention as numbers of the twitterers have come on the log in the past few weeks.

9NQ has been appointed official police report broadcasting station for Galesburg and vicinity. 9XAF, the station of Bradley College, has been appointed for Peoria. Mackley, 9AJ, of the strong signals, is reported to be testing out for the winter business.

Mr. Smith asks that any stations interested in relay work communicate with him for appointments, as good DX stations are scarce, making short jump relays imperative.

MIDWEST DIVISION
L. A. Benson, Mgr.

All A.R.R.L. stations in the states of Missouri, Kansas, Iowa and Nebraska are hereby advised that in January, 1922, a complete reorganization of the entire Midwest Division will take place. All stations are requested to communicate with the Division Mgr.,—L. A. Benson, 4942 Wiesehan Ave., St. Louis, Mo. during the above month, giving description of station and any other points such as traffic handled, distances worked and your ability to act as an official officer of the A.R.R.L. in the Midwest Division. Several of the old officers who have shown keen interest and who have sent in monthly reports will be reappointed. There will be an Assistant Division Mgr. appointed for each state who will be familiar with all traffic handling stations thruout the state and who will also see that keen interest is taken by all stations to make their respective states stand forth as the best. These Assistant Division Mgrs. will recommend for appointment, District Supts. and City Managers. Dist. Supts. will have as many assistants as they deem necessary. The Asst. Division Mgr. of each state will receive all monthly reports from Dist. Supts. and City Managers and together with any other data he may have, send same to the Division Mgr. *not later than the 25th of each month.*

The Assistant Division Mgr. for each state will also appoint what shall be known as a Route Manager who will have complete charge of all traffic routes running thru and in his state. The Route Mgr. will report to the Asst, Div. Mgr. the number of msgs. handled and any new routes which have been formed. All stations thruout the state will report to the Route Mgr. the number of msgs. handled in his station.

It is absolutely imperative that all applications for appointments be in this office before the 15th of January. Each application will be carefully considered and after four Asst. Division Managers have been selected the remaining applications will be sent to the respective Assts. for each state who will select the Dist. Supts. and City Mgrs. Each Asst. Div. Mgr. will be selected according to his ability as an operator and must absolutely be full of pep and familiar with all matters pertaining to traffic and the A.R.R.L.

MISSOURI DISTRICT
9ZAD, Supt.

Msgs. are moving in greater numbers in this territory despite some very unfavorable weather conditions. A surprising number are being handled by CW. 9AOG at Lawrence is on the job regularly and doing good relay work. Other stns.

doing good work are 9AQE, 9BT, 9PS. Msgs. to the north go via 9EX, 9ANO, and 9YO. Msgs. going south and east go over the old stand-by route, via 9YM—which deserves great credit for its consistent relay work.

QRM in Kansas City has been almost entirely eliminated due to the efforts of 9DRQ, 9ASD and 9DJB.

IOWA DISTRICT
9JA, Supt.

Among the stns. now doing good work are 9ZU, who keeps the Sioux City end open for business, 9YAE and 9FZ at LeMars, and 9IY at DesMoines. Coe at Cedar Rapids has opened again using the call 9SG. 9MS is on each night clearing for the Davenport section. 9DRA and 9DQZ at Marengo are proving a great help in getting traffic thru for that section. 9YA will have in operation a 500 watt fone and will broadcast weather, press, etc., each evening at 9:30 on 425 meters.

KANSAS DISTRICT
No detailed report received.

NEBRASKA DISTRICT
9HT, Supt.

Radio has been progressing in the usual manner in the Nebraska district during November, and although some QRN breaks out occasionally, we have had very good radio conditions. For the entire district for the past month about 200 messages have been handled. This does not represent a report of all stations handling traffic. The bulk of the traffic has been through 9HT—140.

9DNC of Lincoln is the most prominent relay station now in operation. Mr. Palmer deserves great credit for bringing Lincoln to the front. It has been dead to the world since the closing down of old 9UQ.

For Omaha 9DIT, 9VE, 9DSM are operating entirely on CW. Mr. Ed. Mars of Southside has done some remarkable work in recording violations of the Omaha Executive Council traffic laws. 9EW, Anderson, in addition to operating a shift at 9HT has his own station stepping out and is handling his share of the traffic through Omaha.

9DUP of Wahoo, Nebr., has been doing some remarkable phone work during November, having been reported in Texas using two five watt tubes. 9AIN, Sanders of Hooper, is handling traffic along the north route across the state and states that there are absolutely no stations in operation in Fremont, a town of about 15,000 people. 9YT, the Wayne State Normal School, is operating a radiophone and reports fine results. 9AFX, Stromsburg, and 9ANF of David City report little of interest from their territory.

There are still a few appointments to be made in this district so let's see what you wide-awake radio men can do.

DAKOTA DIVISION
Boyd Phelps, Mgr.

Swinging was especially violent during the latter part of November in this Division. This phenomenon seemed quite general even with stations that ordinarily do not fade. We offer no remedy but only wish some of them would swing in loud and "stay swung" long enough to get rid of our traffic. This together with the fact that we have among us a greater number of good DX stations has reduced the average distance of each relay jump.

In North Dakota 9WU, 9EE, 9ZX, 9YAF, 9AMB, and 9LW all seem to knock 'em dead with a loud racket and hang up some mighty fine records.

Mr. N. H. Jensen, Dist. Supt., Box 894, Sioux Falls, S. D., reports stations in many towns about the state. The Yankton College Radio Club operating 9YAK under the leadership of Mr. Homer Fitch is an example of what a real live radio club can accomplish in the way of putting on a good DX station. In Aberdeen 9AKX is the leader and is steadily improving his radiophone. Mr. Chas. Norton, City Mgr. of Sioux Falls, reports their affiliated YMCA Radio Club progressing very well. Several contests are running and with the cooperation of the local newspapers in devoting a column every week to amateur radio, the city is a live radio center.

In Minnesota 9ZC has been getting out very well and his 5 watt CW has covered some good distances. 9YAC and 9PN should also be leaders in the northern section of the state. 9XT at Collegeville and 9YAJ at Northfield are both on the air with a good spark and 9BBF at New Ulm with CW. In the Twin Cities 9XI, 9ZT, 9FO and 9AJP are all on the air with CW of considerable power while 9HM, 9XI, 9ZT and several others bang out with spark. Little trouble should be had in clearing traffic with Minneapolis and St. Paul. The Twin City Radio Club has been growing in great shape and with a continual program of contests, lectures, debates, raffles, and what not, it has greatly exceeded the expectations of its original promoters. The Twin City Executive Radio Council continues to function in a very efficient maner in upholding the U.S. and local regulations and deserves great credit for this work.

ROCKY MOUNTAIN DIVISION
M. S. Andelin, Mgr.

The operating personnel of the Rocky Mountain Division has for some time past noticed the urgent need of better organization and co-operation of the amateur stations in the division to overcome the handicaps of fading of signals, constantly varying dead zones, and the necessity of

"back-hauling" messages in order to get them across. A movement has been in progress for some time to test the feasibility of a "Rocky Mountain Trunk Line" where messages can be relayed back and forth with certainty. The tests were such a success that the plan was adopted and numerous other tests were made to ascertain the most efficient routes to be followed. The accompanying map shows the latest developments but is subject to changes toward bettering the plan. The star stations shown in the map have authority to relay to other stations as well as to each other, while the other stations should confine

their efforts to relaying between the star stations unless requested to do otherwise. This is to cut down interference as much as possible.

The plan works out as follows: Each star station clears for business every night, except nights that are set aside for other things. The stations clear in order, each according to its position, the eastern-most station first, the next station in line west second, etc. If any station finds he is unable to work in a certain direction and has traffic for that direction he inquires of a star station on either side of him if he can QSR in that given direction and chances are that one of them can work it thru with ease. This line provides a way for the southern California stations to get their northern messages thru quicker and without encountering the usual coast QRM.

Wyoming, N. R. Hood, 7ZO, Supt., reports the stations in this state have excellent connections east and will make a good clearing house for traffic in any direction. Stations as far east as Chicago are worked and connections with the Mississippi Valley are innumerable. The DX stations at present handling traffic: 7LU, Graybull; 7DH, Hyattville; 7MO, Douglas; 7JQ, Basin; 7OS and 7ZO, Casper. If there are others not mentioned please get in touch with your Superintendent. Stations are few and far between and a jump of several hundred miles is necessary to get out of their own back yard. Conditions call for "back-hauling" messages in order to get them to their destination but a hole is nearly always found on either side. The Rocky Mountains used to be a barrier for Transcon traffic but with the new Rocky Mountain traffic routes we are able to bridge the gap successfully. All stations, large and small, will be given a chance to work as the intra-division trunk lines are being organized now.

Utah, Glen Garmer, Supt., reports the general trend of Utah stations is toward better and more efficient sets, hence many of them are in the midst of building CW. Those who feel that the old rock-crusher is good enough for a while longer are busy keeping their rivals, CW, from gaining any ground on them. New stations are coming into prominence and nearly all the old operators are back on the job. Traffic is going thru in ship-shape. All the stations are enthused over the Rocky Mountain Trunk Line and are giving their support to it.

ALASKAN DIVISION
Roy Anderson, Mgr.

Well, one Alaskan "ham" has broke loose. Let's hope he's setting an example for the rest. This is all very well and has, to a certain extent, been expected, but the fact that he has heard over such long distances as has A. A. McCue, 7IP, Craig, Alaska, seems to cheer us up a little. Mr. McCue advises that he has had very little time to listen in thus far, but I'll say he's heard enough, for one time. Following is his list: November 1—7BH, 6AB, 6AAU, 7IN, 6AK, 6BA, 9BD, and 5AK. Nov. 2—7IJ, 7PO, 6QR, 9BD. Nov. 4—7ZK, 7ZA, 7QR, 6QX.

It is planned to have 7IT, Ketchikan, put in a five-watt set to work 7IP, Craig, the distance being only about eighty miles, and 7IP in turn to work the States. This, if put thru, will mark the opening of a relay route which, we hope, will in time reach far into the interior of the territory.

NORTHWESTERN DIVISION
Reported by R. T. Galyean

EASTERN SECTION: This month shows a substantial increase in the number of messages handled over this Trunk Line A. All DX stations in Montana are in operation. One new station in Bozeman,

7MP, has been staying up until the wee sma' hours and getting over quite a number of messages. The A.D.M.'s station is just about to his satisfaction now, and tho he will not be able to keep a very late watch he expects to clear his share of the traffic. A new station located at Morse, Sask., Canada, has been QSA at Bozeman using a 10 watt tube set.

CW seems to be "taking" in this end of the Division. 7HS is installing a CW set and Helena has nothing else but CW. (Wonder where the squeak boxes are in Helena) 7ZU wants to pawn his spark set for a 1000 volt 400 watt motor-generator and some 50 watt tubes. A.D. Mgr. Cutting advises that all traffic over trunk A be routed via 7ZU or 7ZG for longest jump. 7ZU has two ops. and regular watch is kept every night from 10 till 3 A.M. Traffic to Canada can go via 7EX or 7LY to Canadian 4CB.

IDAHO AND CENTRAL SECTION: 7YA, Boise City High School station, reports that they have been unable to do much work this month owing to the interference from power lines. Nov. 11th, 7YA relayed the results of the Idaho-Wyoming foot-ball game to 7ZM at Moscow, Idaho, where they were given to the students at the State University of Idaho less than 30 seconds after the close of the game—beating W.U. by half an hour. This was daylight transmission of approximately 300 miles.

7ZM at Moscow reports that the route east from there is now in fine shape with 7ZU the best bet for the first jump from there. He has cleared 9WU several times recently and has no trouble copying him. Portland stations are very seldom worked, tho Seattle stations are beginning to come in better with the coming of winter. At Walla Walla, Washington, there are now three licensed stations. One, 7ER (ex 7CN) is raising a 100 ft. pole and will soon be working with a 1 K.W. spark. This is opening up an entirely new territory for radio and also may be of assistance in opening up a short jump route to Portland.

COLUMBIA RIVER AND SOUTHERN SECTION: At Seaside, conditions have been very good for the past month and some of the stations are beginning to get out. 7HD being reported QSA at Eugene and Tacoma. At Portland most of the stations have been laying off for various causes and 7BP has been handling most of the traffic. 7JW is back on the job again with his new transformer.

VANCOUVER DIVISION
Roy Anderson, Acting Mgr.

Wm. D. Wood, Barron Hotel, Vancouver, B. C., ex 6KL and 5BR, is now operating a special licensed station, call 9BD. He advises that he has worked, and been reported QSA by all of the following: 6AK, 6IM, 6QR, 6FN, 6FH, 6KM, 6KA, 6AGF, 6GR, 6IC, 6WZ, 6VX. He is now using a 1 KW Thor, but will soon have a U. W. Coffin.

An attempt is being made by the Vancouver amateurs to locate some good DX stations in Prince Rupert and Victoria. As regards the former, it will probably be some time before anything can be done, for 5CX, Gordon Bulger, advises that the Inspector visited Rupert and complained of the wave length of the stations and as a result there are only two sets in that city. Moreover, as all of the Rupert stations are within five miles of VAJ they are only allowed fifty meters waves length. Nevertheless, it might be possible to do something.

It is expected that Vancouver will have several reliable stations going about Christmas time. At present 9BD, 5BI, 5AK, 9AX and XEQ are the most reliable.

WINNIPEG DIVISION
Boyd Phelps, Acting Mgr.

Here's a new one! Our A.R.R.L. is fast growing as shown by this first report from the Winnipeg Division comprising the provinces of Manitoba and Saskatchewan. May we continue to hear from this new Canadian Division.

Mr. J. A. Gjelhaug, 9ZC, Baudette, Minn., Acting Asst. D.M., is in communication with Winnipeg stations by radio direct or thru 9YAF. Mr. Herbert D. Clark, 4BG, was appointed District Superintendent of Manitoba but unfortunately left for the west coast a few weeks later. The selection of a man to fill this office was put up to the Winnipeg Radio Club and Mr. M. R. Smith, 4AU, 30 Hart Ave. was elected and accordingly given official appointment. Winnipeg will have several good stations handling traffic with U.S. stations this winter. Amateurs in all parts of Manitobia are urged to write Mr. Smith, as a Canadian relay route is under construction.

Saskatchewan amateurs may live in a cold climate but they have warm hearts. They are keen for a Transcontinental Canadian Route and are testing between themselves with this object in view. Mr. Jack E. Maynard, 4CB, Box 339, Morse, Sask., has been appointed District Superintendent of Saskatchewan. 4CB has worked quite a number of U.S. stations on CW and has been often reported in the central part of the U.S. His best distance so far is 1225 miles using at the most two 5 watt tubes. 4CB is trying hard to connect up with 9BD and other CW and spark stations in Vancouver, B. C. who are hearing him regularly. The big difficulty seems to be in working a half K.W. spark set (the limit allowed in Canada) over any

great distance when the 9's and 7's just across the line roll in like thunder. Mr. Paul Socolofsky, 4BV of Loreburn, and Mr. G. J. Shadick, 4BR of Regina, visited 4CB a couple of days exposing themselves to the bite of the CW-Bug so now they are both hard at work getting CW sets lined up for DX work.

Everyone's attention is called to the intermediate signals listed in January 1921 QST and one change announced in the March issue. Falling in line with this plan will mean much in establishing records and the proper routing of traffic. The Division Manager will be glad to forward any correspondence wherever possible even if you have only the call letters.

ST. LAWRENCE DIVISION
A. J. Lorimer, Mgr.

We are pleased to report a big improvement thruout this division during the past month with fairly reliable traffic handling.

The honors this month go to Mr. Eric Farmer of 2CI, who handled 80 messages and kept a reliable schedule with 1AZX, Burlington, Vt., at 6 A.M.

2BG and XPG have been doing very good work with C.W. and are getting out. The increase in local QRM in the vicinity of Montreal, however, is getting so bad that practically no DX work can be done until midnight.

Some local sparks have been acting up so badly of late that the Naval Department at Ottawa have an inspector looking over the stations reported for interference at VCA. We regret that some well-behaved stations have been reported in error and the worse offenders omitted. The Montreal Radio Association has decided to make some reports on stations really causing trouble and try to bring about some improvement.

Mr. Boright has installed a new station at Sutton, Que., (2DK).

Once again we must report a failure in connecting up with Toronto stations tho our best DX stations have worked twice that distance.

At present our traffic for Toronto is going through to 1ARY and then via 8AWP, Syracuse, to 3EI. 8AWP has been worked from 2BF but there is some QSS to contend with in this trasnmission.

We have practically nothing to report from the north. It seems as tho all the activity in that district at the reopening was only a splash of interest. However, as the inspector has to visit Quebec amateurs on the QRM question, there must be something working. Let's hear from you Quebeckers.

ONTARIO DIVISION
A. H. K. Russell, Mgr.

Things radio having been traveling in this neck of the woods since last month's report, which by the way, was the poorest on record as 3BP was the only D.S. to report. However, all the boys have done better this month and from all accounts good relaying has been carried on by all.

The latter part of October was enlivened by the attendance at the 8th district convention of several Toronto, and other Ontario amateurs, in Buffalo. We all met the traffic manager, Mr. Schnell, and Mr. Warner, of QST, and talk was had of a convention in the Ontario Division, at which the latter two relayers promised to try and be present. Johnny Walker is said to be still going strong over here, which may account for the enthusiasm.

No report has yet come to hand for District No. 1, but Carter advises that four Windsor stations are doing DX now with 18 messages handled at 3DH last month. 3DH has gone the way of all flesh and decided to "can" spark and put in 50 watts C.W.

District No. 2 reports by Gowan that relay route Toronto—Ingersoll-London is an accomplished fact, via many Toronto stations, to 3BP, 3QJ (Kitchener), 3GN or 3KG (Ingersoll), to 3QH, 3MN or 3OV in London. This looks like an excellent start for the through route, especially as Hamilton is at last heard from in the person of 3RY. W. H. Gillard, who is copied QSA in Kitchener. 3BA, Wes Mitchell in Brantford, is putting 'em thru. 3DS threatens to open up with the much talked of 25 cycle "sink" but we are hoping not. He also says a 50 watt tube set will be soon running. 3SB, Hainsworth, a well known Canadian hockey player, has heard the call of the king of indoor sports and is putting in a tube set. Messages 27.

District No. 3, under 3BP, has had a banner month, having handled 206 messages, mostly from one part of U.S. to another. Over half this traffic has been handled by CW, Rogers finding that the spark QRM is so bad that it is practically impossible to use spark set. 3BP and 9AW qualified very well for the Transatlantic tests.

District No. 4, Toronto, has been exceedingly lively, but unfortunately the zeal of some of the boys exceeds their discretion with the result that traffic is tied up a good bit of the time owing to several trying to jam their traffic thru at once. 3FO reports 57 messages handled, and 9AW eleven. 9AL managed to jazz into the air just in time to get into this report with 3 messages. A development which may promise well for relay work in the direction of Ottawa is the installation of sets for the Signal Corps at Ottawa and Camp Borden, CAO and ACO respectively. These stations are still experimenting but may be in a position to handle traffic later. They work at present on 1200 meters.

The D.M. had the pleasure of meeting Mr. Staebler of Gananoque who is installing a CW set some time soon, and will help out the Kingston district a lot. He promises to do all he can to help out relay work down east.

A new development has bobbed up in a letter from 4CB in Morse, Sask., who has a ten watt tube set with which truly remarkable work is being done, traffic having been handled across the Rockies. Arrangements are being made for tests to be run with Ontario stations so that communication may be established. An intermediate station at 4AU, Winnipeg, is a possibility, and 5CZ in Vancouver, B. C., also has reported signals QSA many times. Here's to 4CB and may he shove ten watts farther that he ever did before when we get those tests started to him. The D.M. has also had a letter from 9AK in Charlottetown, P.E.I., who is beginning to line 'em out, having worked down the east coast and been heard in Hartford.

WITH THE RADIOPHONE FOLKS

(Concluded from page 30)

indigo, through to violet, differing from each other only in their frequency.

"It is interesting to note that while the ear responds to an actual, physical vibration, the eye responds to an electrical one, and while we do not fully understand these things at present, it is very possible that the phenomenon which actually occurs is the generation of alternating currents of various frequencies in the nerve channels connecting the eye and the brain. In other words, our sense of sight is really a detector of electromagnetic waves.

"Now, I have shown that the eye is sensitive to etheric electromagnetic waves of certain very limited frequencies. There are frequencies very much higher than those of the color violet which are popularly termed "ultra-violet" waves, and we find such very high frequency waves emitted from radio-active substances such as radium, thorium, uranium, and so on, X-Ray tubes, and bodies under extremely high temperatures, such as the sun or the electric arc. These ultra-violet waves are also called actinic waves, and while they are of too great a frequency to affect the eye, nevertheless they are registered on a photographic plate.

"Similarly, below the light waves, there are a great many other electromagnetic waves, the frequencies of which are too low to be distinguished by the eye but which may be detected by other media. For example, below the color red we have a series of radiations popularly termed "infra"—(or below) red waves, the commonest of which are heat waves. You are familiar with the fact that when a piece of metal is heated, such as an iron poker, the vibratory energy imparted to the molecules of the metal cause them to emit electromagnetic heat waves which can be detected by holding the poker near the face or the hand, but which cannot be seen until more energy has been imparted to the poker, until finally the waves are radiated at so great a frequency that they are able to affect the eye and we say the poker is "red hot".

"Below the infra-red, or heat waves, there are electrical waves of frequencies which have been produced in the laboratory but which are too short to be used for wireless communication.

"At the lower end of this chart are shown the waves actually used for radio communication and their frequency varies from about 160,000 to 3,000,000.

"Altho I have shown the frequencies of sound waves which are sensible to the ear, at the lower end of the chart, they are really not electromagnetic waves, but are only included to show you the magnitude of the radio frequencies.

"Each division on this chart represents an octave; that is to say, each unit of frequency is twice that of the one next below it. This means that this chart is laid out according to geometric law and not a straight line progression, because each unit doubles the one preceding. This is similar to the laying out of a slide rule."

C. W. AND SPARK

(Concluded from page 26)

whelming. We hold no brief for the power tube manufacturers—we don't believe their tubes are as good as they should be—but C.W. by some means, tube or arc, is so greatly superior to the spark in so many ways that we really believe the latter is on its last legs.

Just to show you what will happen to a spark station: 9HM bet us a two-years' subscription to QST against a list of Calls Heard that there would be more Sparks heard than C.W. The book-keeper is today sending him a bill for four (4) fish.

RECEPTION WITHOUT AERIAL OR GROUND

(Concluded from page 24)

necessary when tuning the variometers, otherwise the station will be passed over unobserved. Be careful of body effect while tuning in weak signals, as it is sometimes hard to bring in clear signals except by keeping the body perfectly stationary. There is no critical adjustment necessary with detector and two stage amplifier, and the same plate potential is used as under ordinary receiving conditions.

Of the numerous stations recorded, the following are some of the greatest distance: 8OZ, 8RQ, 8AGK, 8JL, 9ZN, 8BC, NSF.

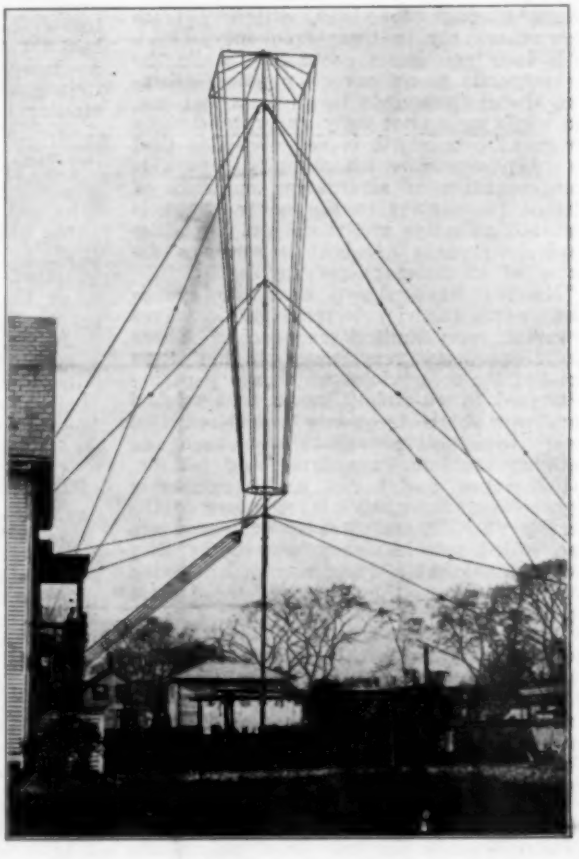
Amateur Radio Stations

1AFV, Salem, Mass.

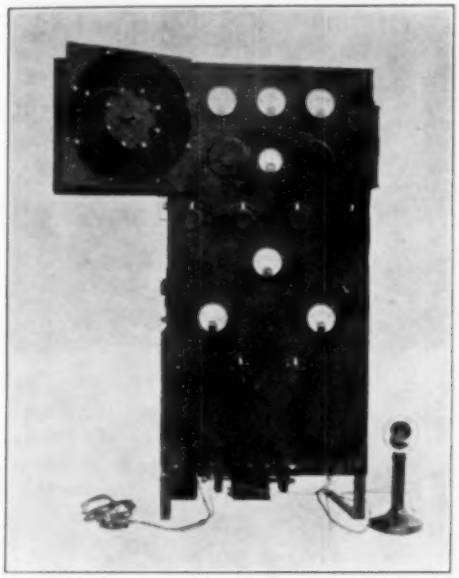
Here is a real CW station owned by F. Clifford Estey, of Salem, Mass. Estey tells us that to build it he sold his automobile and spent a thousand dollars in five weeks of hard work. The results, however, would seem to be well worth all of his effort.

The antenna is a most unusual one but of a design that appeals to us very much. Located in a small yard it was impossible to consider the conventional flattop but at the same time it was also desirable to secure as high as possible a center of capacity. The mast is 70 ft. high, of three 27 ft. wooden sections lapped and bound by straps. The aerial is in reality a vertical cage with the mast rising inside it. A most ingenious arrangement is provided to secure this. The twelve vertical wires are supported at the top from a spreader which takes the form of a square 11 ft. on a side, assembled of four 10 ft. lengths of 3" copper conductor pipe and four 3" ells for the corners, securely soldered together and the whole hung from the mast-head. The insulators are really at the mast-head and from there the 12 wires run out to the square spreader, make three turns around it and drop to the lower hoop, (which is of ½" copper tubing and four ft. in diameter, 21 ft. above the ground) where each wire is attached and shortly below this gathered into a 12-wire one-ft.-diameter cage which forms the lead-in to the station.

Estey is a master mechanic and tool maker, and so rather naturally his panel transmitter is a thing of beauty. A bakelite panel 10" x 38" carries all of the equipment except the rectifier and transformers. The photographs will be self-explanatory in the main. Four 50-watt tubes are used as oscillators and when the set is used as a phone two 5-watt tubes are also employed as speech amplifiers. Just below the shelf carrying the power tubes, two oil-immersed variable condensers will be noticed, which are actuated from the front of the panel. The circuit employed is the one that QST has been so consistently boosting of late, the so-called Stanley circuit as originated by the British during the war and first

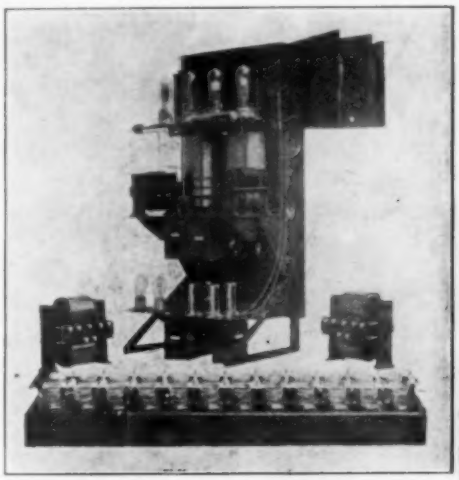


described in these columns by 1DH in QST for July. In reality the circuit is a modified Hartley and is known in engineering circles in this country, we believe, as a "reversed feedback" circuit.



The rectifiers consist of 24 pint preserve jars containing a borax solution in which the elements of lead and aluminum are mounted. It is essential that pure aluminum (at least 99%) be secured. The elements are 1/16" thick x 1" x 6" with an end bent back and a machine screw mounted for connecting up.

Estey uses a counterpoise and started out by stringing up 1200 ft. of seven-strand copper wire in a 36 ft. square screen. He got pretty good antenna current but discovered that the meter reading was greater in the antenna lead than in the counterpoise lead, which led him to believe that some more counterpoise might not be amiss. Accordingly he put in a couple hundred feet more and saw the antenna meter climb a little. Some more of the same business. To make a long story short, he quadrupled the amount of wire in the counterpoise until now it is so dark in the backyard that the grass won't grow because the sun can't get through to it. Incidentally the antenna current has climbed steadily from 4.5 amperes until now the meter reads 12 amperes (thermo-couple) when all four tubes are used.



Rear of Panel, and Rectifier

In only a few weeks of operation this station has established consistent operation with many points over 1000 miles distant and has been reported from every state this side of the Mississippi River. Estey has shown that it is possible to jump in on a big job and with the proper knowledge carry it through to a successful conclusion in a minimum elapsed time.

9HM, St. Paul, Minn.

Station 9HM is located in the center of a square piece of land, the building proper being a small two-room house built by "the gang" last summer, and electrically heated. As an indication of the trend of the times, a bunk is provided for the tired "op" to flop into when he knocks off in the early morning. The station is operated by C. J. Otterholm, "CY"; M. E. Miller, "NP"; P. C. McKendrick, "ML"; L. Houska, "LH"; and Herbert Richter, "RC".

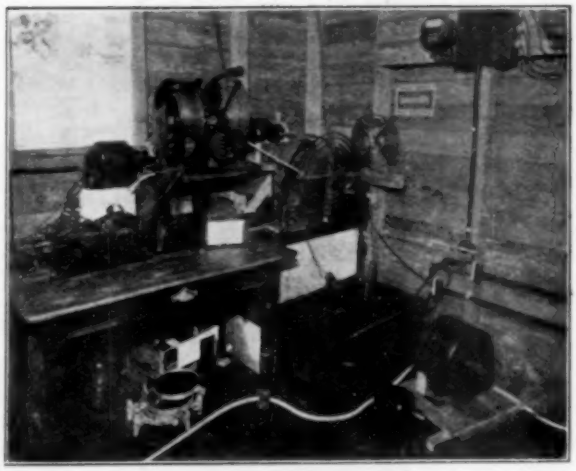
The aerial in use at present is a 5-wire inverted L 60 ft. high and 60 ft. long, with a counterpoise of the same dimensions directly under it and 10 ft. above the ground. A new antenna system is under construction, one of the new 90 ft. masts being ready to raise.

Two of the four transmitters planned for 9HM are now in operation. Unit "A" consists of a 1 k.w. United Wireless "coffin" transformer, ½-inch plate-glass-in-oil condenser, Arrow synchronous gap of the spark-thru type, and a heavy O.T. having 3-in. ribbon in the primary. The leads are extremely short in the closed circuit of this set (the right-hand one in the photo), which permits unusually large capacity to be used, Mr. Otterholm claiming to get good results on 195 meters with a capacity of .02 mfd., the antenna current being 6 amperes on a thermo-couple meter.

Unit "B" is composed of a 1 k.w. Clapp-Eastham Type E transformer, 10-tooth non-sync rotary gap on 3400-r.p.m. motor, glass-in-oil condenser, and a T&H oscillation transformer. Normal antenna current of this set is 5½ amps., thermo-couple.

As planned, Unit "C" will be a 100-watt CW and phone set and "D" a 1 k.w. 500-cycle quenched and synchronous panel set.

The receiver is the usual variometer tuned-plate type with two-step amplifier and Baldwin phones—rather a standard among relay men. To the right of the tuner



is the change-over switch and above this a control panel supporting a Jewell thermo-ammeter and a large switch for selecting the transmitter.

9HM has been heard in almost every state in the Union and Canada and by ships at sea in several directions. Both transmitters work the east coast with ease most good nights. Unit "A", however, is the only set heard on the west coast. By means of colored pins a record is kept on the map of stations over 1000 miles distant who have worked or heard 9HM.

3SM, Philadelphia

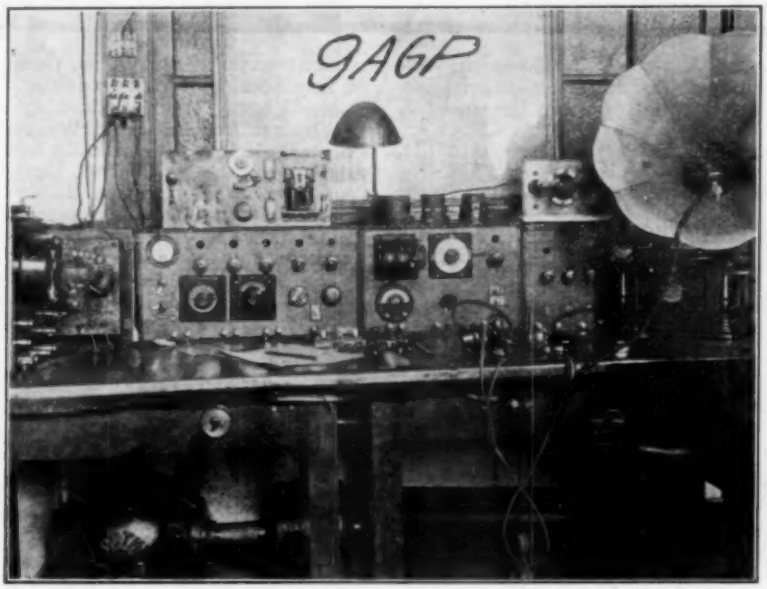
This very neat little station is owned and operated by Robert Adams, 3rd, of Philadelphia, and is a good example of what can be accomplished in a compact, efficient installation.

3SM has a four-wire cage aerial supported 60 ft. above ground on two 25 ft. poles on the roof. The large cabinet on the right contains an Acme ¼ KW transformer and an oil-immersed condenser. On top of the cabinet is a Chambers oscillation transformer of the helix type, behind which is a Bunnell rotary gap. The receiving set is of the conventional regenerative type, with detector and two steps of amplification, and Brandes phones.

3SM has an antenna current of 2.4 amps. and has been heard at 4CX, 8FE, 8ZA, 8HJ, etc., which is very good work for a ¼ KW.

9AGP, Chicago

9AGP is the station of the Wabash Radio Club, with headquarters at the Y.M.C.A. at 3763 Wabash Ave., Chicago, operated by Messrs. P. R. Piper and F. H. Wauh.



The receiving outfit consists of honeycomb coils and a three step amplifier using Western Electric VT-1's thruout. The transmitting side has a home-made five tube C.W. set, following, with few exceptions, the description of a set given in QST for May, 1920, and a quarter kilowatt German portable set, the latter being seen just to the left of the lamp in the photograph and resting on top of the C.W. set. The high potential for the C.W. set is obtained by driving an old 220 volt 1/7 h.p. motor as a generator, from a 1½ h.p. motor. The generator was originally series wound but is now separately excited thru a lamp bank, and delivers up to 750 volts. Tape is used for a driving belt, the beauty of which is that when there is an overload on the generator the tape chews in two.

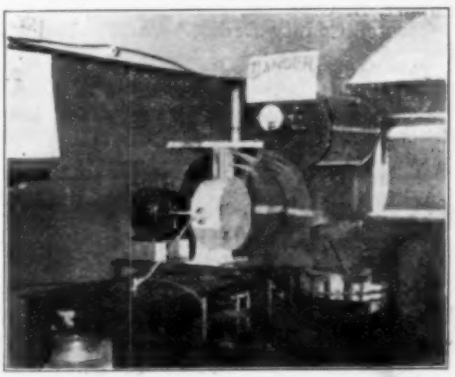
9AGP has a bad location, being in the basement of a five story building and having a lead-in about 100 ft. long which, without any flat-top, has a natural wave length of 210 meters, so that all operation has to be done thru a series condenser with much loss in efficiency which at present can't be helped.

9ABL, Kankakee, Ills.

9ABL is the station of Manley Potter, Jr., at Kankakee, Ill., 50 miles south of Chicago. Its antenna is 75 ft. long, 32 ft. and 44 ft. high at the respective ends, composed of six wires spaced 2 ft. apart, and having a natural period of 171 meters.

The transmitter consists of a United Wirelesss 1 kilowatt open-core transformer; a Benwood gap which may be driven either synchronously or non-synchronously; home-made O.T. having four inch ribbon on primary and three inch on secondary and A.T.I.; and a condenser consisting of 12 Leyden jars connected in series parallel to

(Concluded on page 55)



THE A.R.R.L. takes pleasure in announcing the affiliation of the following societies, dating from December 2, 1921:

Vermilion County Radio Assn., Danville, Ill.

Wheeling Wireless Assn., Wheeling, West Va.

Nirasco Radio Club, Bowling Green, Ky.

Central Illinois Radio Club, Springfield, Ill.

The Delaware Radio Assn., Delaware, Ohio.

Delaware Radio Assn., Wilmington, Del.

Youngstown Radio Club, Youngstown, Ohio.

The Radiotec Club of Akron, Akron,

The Yankton Radio Club, Yankton, S. Dak.

Elizabeth Radio Club, Elizabeth, N. J.

Bloomfield Radio Club, Bloomfield, N. J.

Mon-Yough Radio Assn., McKeesport, Pa.

Canandaigua Radio Assn., Canandaigua, N. Y.

Mobile Radio Club, Mobile, Ala.

Northern Orange County Radio Assn., Orange Co., Cal.

Birmingham Wireless Assn., Birmingham, Ala.

Englewood High School Radio Club, Chicago, Ill.

Providence Radio Assn., Providence, R. I.

"DX" Radio Club, Richmond, Ind.

Univ. of Maine Radio Club, Orono, Maine.

Ansonia Radio Assn., Ansonia, Conn.

Prince Rupert Radio Club, Prince Rupert, B. C.

Chester County Radio Assn., Parkesburg, Pa.

The Interstate Radio & Research Club, Haverhill, Mass.

Long Beach Radio Research Assn., Long Beach, Cal.

Tualatin Radio Assn., Cornelius, Ore.

Naperville Radio Club, Naperville, Ill.

White Plains High School Radio Club, White Plains, N. Y.

The First Radio Assn., Flint, Mich.

New Mexico State College Radio Club has installed a high power transmitter with two 250-watt tubes in the main transmitter. At the recent election of officers E. F. Kierman was elected president; M. White, secretary-treasurer, and R. W. Goddard, Dean of Engineering, faculty advisor. Meetings are held every other Wednesday evening.

Wireless Association of Worcester, Mass. Polytechnic Institute recently constructed a new cage antenna 90 feet long, about 80 feet high. The station is in operation every Friday night commencing at 8:00 o'clock. Basket-ball scores will be reported by radio.

The Third and Fourth District Convention will be held in Washington, D. C., on February 17th and 18th. The whole event will take place in the Raleigh Hotel. There will be most interesting exhibits of stations 3ZY, 3XF, 3ZO and many others; tours to NAA, NSF, National Capitol, the parks, and the Washington Monument. Papers will be presented on CW, phone, the Armstrong Super, radio frequency amplifiers, etc. A fund of information will be available on everything in amateur radio. Speed and QRM copying contests will be held with valuable prizes. The convention will end with a banquet and plenty of first-class eats. Reservations should be made with E. R. Bateman, 1217 W. Lafayette Ave., Baltimore, Md. If you miss this convention you will not live long enough to get over your regrets.

The Columbus (Ohio) Radio Club elected new officers as follows: J. Martin, 8TJ, president; M. F. McDowell, vice-president; F. Harmer, secretary; S. Heston, treasurer and V. M. Lucas, radio advisor. Local "Quiet Hours" were adopted, 7 to 9 P. M., during which period no transmiter is permitted to open up unless called by an outside station.

The Hill City Radio Club, Summit, N. J. held a get-together meeting on October 27th with Mr. H. C. Gawler as one of the speakers. Mr. Gawler told of club organization and how to make a "live-wire" club. Mr. Ryan of the Western Electric Co. gave an illustrated lecture on the Catalina-Los Angeles radiophone service. After refreshments were served, a ham-fest was indulged in by all present.

The Milwaukee Amateurs' Radio Club enjoyed a very interesting lecture on December 8th on "The National Electrical Code and its application to radio signalling," by Mr. A. C. Schultz, Electrical Inspector of the Wisconsin Inspection Bureau.

The Houston Radio Club staged a demonstration at the Y. M. C. A. annual Hallowe'en Stunt Party that caused much favorable comment and brought forth constant applause. At the recent Houston Fair, a station was installed and two operators answered the questions of the public during the periods of operation. Voice and music were available, due to co-operation on the part of several local stations in addition to the station operated by Sgt. Hinslee at Ellington Field. Much interest was shown by the crowds who attended the fair.

The St. Louis Radio Association is publishing a snappy little paper, "The Hot Wire." But why wouldn't it be snappy with "Bill" Woods as editor? "Bill" is famous for his "Dear Eddy" stories that appeared in QST before the war.

The Nola Radio Club held a meeting on November 18th which was attended by every member of the club. Not a seat was vacant. F. B! The "Phoneytron," a paper published by the club, is a splendid means of keeping its members informed of what is going on and has helped swell the membership considerably. It has proved one of the best stimulants for good atendance at meetings.

The Radio Club of Tacoma boasts an increasing membership since it has adopted the policy of a social meeting on alternate meeting nights. Miss Winifred Dow was elected "chairman" of this committee. (Evidently this club has several "YL's").

The Radio Club of Brooklyn has lost the services of its president, Mr. Charles Hild, who passed away on September 18th. Mr. Hild, who was one of the pioneers of radio in Brooklyn, was president of the club for two years and in that office did much towards the shaping of the destinies of the organization.

The South Bend Radio Association was formed by a merger of the St. Joe Valley Radio Association and the South Bend Radio Research Club, on October 14th. Officers were elected as follows: F. J. Libbie, president; A. Brady, vice-president; V. A. Bloomquist, secretary and treasurer. Meetings are held every second Friday at 7:30 P. M.

The annual New England Traffic Men's Convention was held in Springfield, Mass., on November 26th. A visit to WBZ, the Westinghouse phone station, was one of the attractions. From 6:00 to 7:30 P. M. everyone enjoyed a ham-fest in the lobby of the Highland Hotel, at which place the banquet was held. Our president, Mr. Maxim, addressed the meeting via the phone station WBZ and a loud-speaker at the hall. Mr. G. R. Entwistle, manager of the New England Division, presided at the business meeting which followed a few short addresses. Much plain talk at the meeting made everyone feel that the New England Division was out to lead all others in traffic work. It seems that the two factions in Springfield are a thing of the past as a result of what Mr. Castner said on organization. About 75 men attended the meeting which finally came to a QRT at two in the morning, but no one regrets having stuck it out to the end.

A New York State Capital Radio Convention will be held at 2XQ, Union College, Schenectady, New York, Saturday January 14, 1922. All amateurs of the Capital district are urged to be present, as well as all others who may find it convenient to attend.

Arrangements are being made for a good display of modern CW, phone, spark, and receiving apparatus. Several manufacturers have already offered showings and demonstrations of latest types of apparatus. Authorities on radio will present timely topics in radio.

For detailed information address Radio Convention Committee, Union College, Schenectady, New York. Write now so we can make arrangements for a large number.

Michigan Convention

The first Michigan A.R.R.L. convention and get-together will be held at Lansing, February 10 and 11, 1922. Michigan is rapidly coming to the front as one of the live spots and we expect that every one will be aware of the fact after the first of February. The program follows.

Fri., Feb. 10.

6 P.M.—Big feed and introduction of stations.

8 P.M.—C.W. discussion, Mr. Darr, 8ZZ, Mr. Wyckoff, 8YG, and others.

Sat., Feb. 11.

9:30 A.M.—Lecture on radio, illustrated by lantern slides and experiments. Dr. Williams of the Univ. of Michigan.

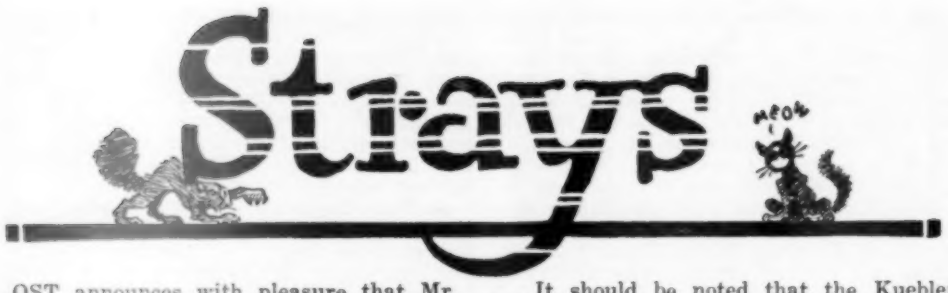
1 P.M.—Section Meetings.

(a) Traffic—Mr. Darr, Dist. Supt.
(b) License Exams. Mr. Edwards, R.I.
(c) Receiving apparatus — Mr. Wilcox, 8XS.
(d) Trips to Local stations.
(e) Club and Boy Scout work.

4 P.M.—Michigan organization meeting.

8:15 P.M.—Theatre party. Special stunts by Detroit Radio Association. Strand Theatre.

Address all inquiries to M. H. Pancost, 1101 Climax St., Lansing, Mich. Address inquiries regarding exhibits to C. R. Pardridge, care of Saginaw Electric Co., Saginaw, Mich.



QST announces with pleasure that Mr. Robert C. Higgy, of 8IB, Columbus, Ohio, has accepted a position on its headquarters staff as an assistant to the Editor.

The F. D. Pitts Company, of Boston, announce the opening of a new store at 193 Westminster St., Woolworth Bldg., Providence, R. I., in charge of Mr. H. A. Tilley.

Newspapers of Kokomo, Ind., in early December chronicled a perfectly wonderful confusion in the wire systems of the Western Union and the L. E. & W. railroad due to the wireless activities of a small boy who lived on the edge of the town. It seems that in order to get an aerial this youthful Macaroni twisted a rock to the end of a wire which was destined to serve for his lead-in and swung it over the telegraph wires where it neatly short-circuited five main trunk lines and gave him an aerial 160 miles long, stretching from Indianapolis to Michigan City. Of course, pandemonium reigned in local telegraph circles and we can imagine that considerable patch-work was in evidence on those railroad switchboards until the trouble was finally located.

Recent attempts on the West Coast to span the Pacific as far as Honolulu were unsuccessful, but we are perfectly willing to bet that that could be done too. Operator I. Ellingham, of the Auxiliary Yacht "Aloha", advises us that on a home-made "oatmeal" tuner he heard Station 7IN, of Silverton, Oregon, working very QSA and steady for a period of about two hours around midnight Pacific Time, Oct. 26th, while the "Aloha" was 110 miles to the east of Hilo, Hawaii.

The "Aloha" is on a cruise to Japan and Mr. Ellingham has kindly consented to listen for amateur signals all the way across. Perhaps we will get some real records from this.

We understand that the Montreal Power Company is actually *helping* amateurs to start in wireless and selling them radio apparatus!

Boy, take this dime and get me one of Woolworth's one-kilowatt tubes; then chase that pale blue elephant off the front porch.

It should be noted that the Kuebler Radio Co., of 321 Huron St., Toledo, Ohio, are the successors to the retail department of the Marshall-Gerken Co., of that city.

We understand that since CQ became unpopular, every time 1BDC in Southbridge, Mass., wants to let the gang know he is on the air he calls 1GY—because 1GY is never on! How's that for a CQ? And by the way, Brother Bates, why don't you fool him some time by answering him?

At last Vermilya has fallen for C.W. and 1ZE is now a 100-watt tube set. Not a trace remains of the old spark set, which has been sold to a nearby amateur and is now signing 1AEV.

We will not be surprised to be advised at any time that Matty has canned the rock-crusher at 9ZN, but if he wants to get more than $3.89 for it he had better sell it quick.

We wish we could report that—

The Electric Light Companies have agreed to use direct current for house lighting in voltages between 500 and 1,000, depending on the subscribers' choice in the matter.

The United Cigar Stores are issuing special radio coupons with each purchase. Twenty of these may be exchanged for a vacuum tube.

The College Entrance Board announces in its annual statement that in the future a first grade radio license may be applied for credit on any engineering degrees.

Recent News Service pictures show a cow-person on horseback with a portable radio set, overhead antenna, etc., all prepared to round up stray cattle. The thing that bothers us is what do they do for a ground—have a binding post in the horse's side, we guess!

In the call books the owner of station 5IR, C. B. Baxter, is shown as located in Pensacola, Fla. This is obviously an error as Florida is in the 4th district. Mr. Baxter's correct address is Box 176, Dublin, Texas. All interested please take due notice hereof.

The call letters 2BML and 2EH are both assigned to the station of the Radio En-

gineers' Club of Riverhead, Long Island, P. O. Box 13.

9ARU, of Louisville, Ky., is broadcasting police news on Monday, Wednesday and Friday nights at 10 p.m., Central Standard Time, on straight C.W. Reports from receiving stations will be appreciated.

To Old 9TI

Old 9TI, pride of the West
Has gone unto his heavenly rest,
His shack is bare, his fones are still,
His key at rest, his spark is nil.
As through my cards I look I ponder,
And think of 9TI out yonder,
Wonder if he, in his heavenly berth
Still hears my sigs from here on earth.
Hearing his call still on the air
Deep down I sink in my Morris chair,
Listen in vain for his well known fist
Calling his friends through the ghostly mist.
May new TI preserve for us
Ken's record; keep it glorious,
Hold it aloft, a record of worth,
A standard for those he left on earth.
We will remember, old 9TI,
Remember you till the day we die,
And join you again in your haven of rest,
Where good Radio Men are forever blest.
—7ZO.

Here are a few more records that have just come to our attention.

2BAK, Tarrytown, N. Y., we understand has been heard in Juarez, Mexico, on November 12th, while putting out 0.9 ampere C.W., signals QSA.

6VP reported at 8FQ, Pittsburgh, while calling 2BK; audible 6 ft. from phones.

9AIY, Milwaukee, heard by 5AA, DeBen of New Orleans, while using a single Western Electric VT-1 with 170 volts on the plate. This CW stuff surely travels!

6ALE reports the signals of 8XK on the night of November 5th on AC CW, loud and steady in Transatlantic Preliminaries. He also reports 8UJ calling CQ MSG, clear and readable on November 6th. 8XK has also been copied by 6XAG in San Jose, California, audible on one tube, readable on one step, typewriter signals on two steps, and all over the room on three steps.

8LW, Ambridge, Pa., using one 5-watt tube, reported very QSA at 9DUZ, Ellendale, North Dakota, on detector alone on November 10th; wave length 214 meters, distance 1100 miles.

Wouldn't it be wonderful—

If some fellows could raise something besides QRM?

If 1TS reported calls NOT heard to save valuable space in QST?

If WNY got wise to himself and found out his decrement?

If a fellow didn't feel like a filbert the first time he bawled into a radiophone transmitter?

If the R.C.A. would buy up all the arc stations so it could shut 'em all down so it could sell lots of tubes so we could all use C.W. so we could all be happy at once?

If some hero would say QRS instead of QRM when he missed one at about 40 per?

If some C.W. stations knew we had such a thing as a filter?

If a certain spark coil near Cincinnati knew just how far distant POZ was and would stop calling him long enough to see whether or not he was being answered?

If that guy up in Washington, D. C., were to sign 3KM instead of 2KM or 2DM?

If WWX ever raised any other post office station without messing up the ether for two hours?

If we all cleared traffic like 4GL and 3ZY?

If a lot of fellows would run the dern thing either entirely synchronous or else frankly non-synchronous?

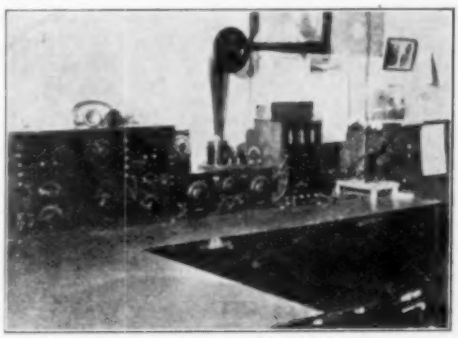
If NAI would quit signing NL?

9ABL, KANKAKEE, ILLS.

(Concluded from page 51)

give a total capacity of .006 mfd. This equipment puts 5.4 amperes in the antenna.

Instead of the customary change-over-switch, 9ABL uses an anchor gap in the aerial lead to eliminate the unpleasant voltages that otherwise would be experienced from this transformer at the receiving terminal of the switch.



The receiving equipment comprises a Grebe CR-3, a home-made Universal tuner covering wave lengths up to 20,000 meters, detector and two-step, Baldwin phones and a Magnavox. Mr. Potter is using Radiotron UV-201 tubes throughout, with 90 volts on the plates, and states that he obtains better results this way than in the normal use of a UV-200 and a detector.

Calls Heard

HEARD DURING NOVEMBER
Unless Otherwise Specified

Amateurs reporting lists are requested to see instructions appearing at the head of this department in previous issues, and to observe the following additional instruction.

(4) In order to distinguish between spark and CW stations, list spark stations from 1 to 9 in the usual manner, and then make a second paragraph in identical form listing the CW stations.

HEARD AT SEA

G. W. Spare, opr. S. S. Richmond. Oct. 29, 939 miles west San Pedro, Calif., 9WU, 7YS, 5ZA, 7IN, 7ZP, 7ZU. Oct. 30—9YB wkg. 9XI at 7:21 p.m.

On board KRO. A. H. McNaughton of 3HJ. Nov. 8, 25 miles south Phila., 1ZE, 3ACR, 3AGN, 3AQH, 3BG, 3EH, 3HD, 3HJ, 3IJ, 3II, 3KN, 3RW, 3XC, 3YP, 9AAW; Nov. 9, 35 miles south Phila., 2BK, 3HD, 3XJ, 3YP, 3YQ, 3ZA; Nov. 10, 70 miles east Cape May, 1AW, 2BK, 2FP, 2OM, 3HG, 3HJ, 3LP, 3PB, 3AIS, 9ZJ, Can. 3BP. C.W.—1TS, 2AKO, 2FD, 2UK, 2WP, 2FP, 3ZY, 3BA, 3DH, 3PB, 4BY, 4GL, 8BOX, 8ZZ, NSF, XF1; Nov. 11, 300 miles east Cape May, 1AW, 1ASF, 1DZ, 1GM, 1RV, 2BK, 2DN, 2DX, 2FB, 2FP, 2OM, 2AQI, 2ABM, 2EL, 3AHF, 3HX, 3KM, 3OU, 3US, 3VW, 4EA, 8AQV, 8AYN, 8AFD, 8FT, 8SP, 8XE, 8ZY, 9AMT, 9ME, 9MC, 9PC, 9UU. C.W.—1TS, 1AFV, 1AWB, 2AJF, 2AWL, 2FP, 2VH, 2ZL, 3AAE, 3MO, 3ZO, 8ZY, 4BY, 4GL, 8BRL, 8ZD, 8ZZ, 8II, WJD fone, XF1. Nov. 12, 530 miles east Cape May, 1AMD, 1AW, 1ARY, 1OJ, 2DR, 2EL, 2UA, 3ACM, 3HJ, 3OU, 3ZA, 8AFD, 8AGK, 8FT, 8AYN, 8XE, 8YM, 9OX. Can. 3BP. C.W.—1ANQ, 1QP, 1TS, 1XM, 1ZL, 1BWJ, 2FD, 2WF, 3BIY, 3MO, 4GL, 5LA, 8AHZ, 8BEF, 8BK, 8RQ, 8XK, 8XU, XF1. Nov. 13, 770 miles east Cape May, 1RV, 1SN, 1FU, 1AZK, 2XQ, 2FP, 9OX, 1BDI, 2FP, 2XQ, 8LX, 8UJ. Nov. 14, 1000 miles east Cape May. 1ARY, 1APO, 1RV, 2DR, 2OM, 3BGT, 3XM, 8BRL, C.W.—1AFV, 1BWJ, 3BA, 4BY, 8AWP, Nov. 15, 1240 miles east Cape May, C.W.—1AFV, XF1, KDKA?

On board VGNF at Chorrera, Mexico. C. G. Fisher, opr., Nov. 28, 5XD, 5XJ, 5XU, 5ZAK, 5ZX, C.W.—1ARY, 2AAX, 2EH, 3ZY, 4BY, 4EL, 4IE, 4LE, 4XC, 4ZF, 5IR, 8AWP, 9AJA, 9IV, 9NX, WL2, Nov. 29, 5EF, 5NK, 5QS, 5XJ. C.W.—1XM, 2FF, 2FP, 4BQ, 4BY, 4GL, 4II, 4KC, 4XC, 5KD, 8BOX, 8GV, Can. 9AW, 9NX, 9QT, 9ZV, WL2.

Can. 3JI, Toronto

C.W.—1QP, 1RZ, 1TS, 1UN, 1XM, 1AFV, 1ANQ, 1ARY, 1AXI, 1BKA, 1BWK, 1CAK, 1CIK, 2EH, 2EL, 2FD, 2FP, 2IA, 2KU, 2UD, 2VA, 2XB fone, 2ZL, 2ZV fone, 2AAX, 2AFP, 2AJF, 2AJW, 2AWC, 2AWF, 2AWL, 2BEA, 2BER, 2BJG, 2BMI, 2BRB, 2CCL, 2IBQ, 3CA, 3DH, 3FS, 3RF, 3SQ, 3ZO, 3ZY, 3ZZ, 3AHK, 3ANU, 3BIY, 3BMI, 4BQ, 4BY, 4EL, 4EN, 4GL, 8CI, 8DR, 8GV, 8IQ, 8JL, 8KM, 8KS, 8LX, 8PK, 8QM, 8UK, 8UY, 8VJ, 8XH, 8XK, 8XM, 8XV, 8ZG, 8ZJ, 8ZN, 8ZY, 8ZZ, 8ADR, 8AQF, 8AWC, 8BDU, 8BFX, 8BJV, 8BRL, 8BSJ, 8BU, 9XI, 9ZJ, 9ZY, 9ACV, 9AHS, 9BBF, Can. 3BP, 2BN.

Spark—1AW, 1MA, 1OE, 1SN, 1YD, 1ZE, 1ARY, 1BDT, 1BGF, 1BLE, 1BVB, 1CAE, 2BK, 2BM, 2DA, 2DR, 2EL, 2GK, 2IL, 2JU, 2OM, 2OO, 2RB, 2SJ, 2TJ, 2ABM, 2AID, 2AIM, 2ALM, 2AWY, 2BQK, 2BSC 3CC, 3CG, 3DM, 8HJ, 3HX, 3LP, 3PU, 3RW, 3ACE, 3AIC, 3AQR, 3ARM, 3AUW, 3BFU, 4AG, 4BQ, 4CX, 4EA, 4EY, 4FD, 4DQ, 5DA, 5XA, 8CG, 8DZ, 8EW, 8EZ, 8FI, 8FJ, 8FO, 8FW, 8HJ, 8HU, 8HY, 8JQ, 8KU, 8MZ, 8NO, 8RQ, 8RZ, 8TZ, 8UQ, 8WA, 8WD, 8WO, 8XE, 8YN, 8YO, 8ZC, 8ACF, 8ADQ, 8AEO, 8AFB, 8AFD, 8AHJ, 8AHS, 8AIO, 8AIZ, 8AMB, 8AMM, 8AMZ, 8AOK, 8AOT, 8APB, 8AQV, 8ASK, 8AVD, 8AXC, 8AXQ, 8BCI, 8BDY, 8BEN, 8BRL, 8BUK, 9AR, 9CP, 9EF, 9ET, 9GC, 9HM, 9KR, 9LF, 9MC, 9ME, 9SN, 9TL, 9TO, 9UG, 9UH, 9UU, 9UY, 9WD, 9XI, 9YQ, 9ZA, 9ZN, 9AAW, 9ACB, 9ACL, 9AGN, 9AIR, 9APQ, 9ASJ, 9ASR, 9AWX, 9AWZ, 9BVA, 9DKV, 9DYU; Canadian 3BP, 3KS.

Can. 9AK.—Charlottetown, P. E. Island

1AW, 1HK, 1CM, 1ACO, 1IA, (1UL), 1ZE, 1AZK, 1BLE, (1ARY), 1RV, 1AMO, 1OE, 1YD, 1ASF, (1BIR), 2ASL, 2AIM, 2AWF, 2EL, 2OM, 2JU, 2BM, 3BG, 3BM, 3GE, 3BFU, 8AMB, 8AMZ, 8APB, 9AZ, Can. 3BP, 1AO.

C.W.—1ARY, 1AZD, 1AZW, 1BDI, 1BQE, 1BIS, 1UN, 1TS, 1PT, XF1, 1BWK, 2AWK, 2AWL, 2AJW, 2BML, 2BSC, 2EH, 2QR voice, 2RM, 3ZO, 3AWP.

Can. 5BX, Vancouver, B. C.
Oct.—November

Can. 4CB, C.W., 6AAT C.W., 6AE, 6AEZ, 6AGF, 6AR, 6CV, 6EX, 6GR, 6HG, 6KM, 6QR, 6VM, 6VX, 6WZ, 6ZAD C.W., 6ZM, 6ZU, 6ZV, 6ZX, Avalon fone, Kennedy fone and C.W., 7BH, 7BJ, 7BK, 7BP, 7BR, 7BS, 7ED, 7EG, 7EX, 7FI, 7GA, 7GJ, 7HD, 7HF, 7IN, 7IU, 7IW, 7IY, 7JW, 7KB, 7KJ, 7LR, 7LY, 7MF, 7MP, 7MU, 7MW, 7NL, 7NN, 7OZ, 7TJ, 7XD, 7XF C.W., 7YA, 7YL, 7ZK, 7ZM, 7ZR, 7ZS, 7ZT, 7ZU, 9MC.

Can. 3KK, Agincourt, Ont.

Spark—1ADL, 1AEV, 1AMD, 1ARY, 1AW, 1BDC, 1BGF, 1BIR, 1BKP, 1BLG, 1GM, 1IA, 1OE, 1OJ, 1QP, 1RV, 1SN, 1WY, 1YD, 1ZE, 2AHU, 2AIM, 2AJE 2AQI, 2ARB, 2ARK, 2ARY, 2AWF, 2AYM, 2BK, 2BM, 2CAP, 2DA, 2DR, 2DX, 2EL, 2FP, 2JU, 2OM, 2OO, 2PV, 2TF, 2TS, 2UA, 2UE, 2WB, 2WM, 2XK, 2ZC, 3ABI, 3AC, 3ACM, 3AHF, 3ALN, 3AQR, 3AQV, 3BFU, 3BG, 3CG, 3CN, 3EH, 3FB, 3GX, 3HJ, 3IW, 3KU, 3KM, 3OU, 3OW, 3PB, 3PU, 3QW, 3RW, 3TH, 3UQ, 3US, 3VW, 3XF, 3XM, 3ZA, 3ZO, 3ZS, 4BQ, 4AG, 4GN, 5EK, 5ER, 5FJ, 5JD, 5YL, 5ZA, 5ZAK, 8ABP, 8ACF, 8ADG, 8ADQ, 8AFD, 8AGK, 8AHI, 8AHS, 8AJW, 8AKW, 8AMB, 8AMM, 8AMZ, 8ABP, 8APB, 8APQ, 8AQV, 8ARD, 8ARK, 8AVD, 8AWP, 8AYN, 8AYM, 8BBU, 8BDN, 8BEP, 8BFV, 8BM, 8BRL, 8BVA 8BWD, 8BWE, 8CG, 8DJ, 8EB, 8EC, 8EF, 8EW, 8EZ, 8FA, 8FI, 8FT, 8GW, 8HA, 8HG, 8HL, 8HU, 8HY, 8IL, 8IN, 8JQ, 8LH, 8MZ, 8NO, 8OE, 8OI, 8OM, 8PT, 8PX, 8QC, 8RB, 8RQ, 8RU, 8SP, 8TK, 8TT, 8UH, 8UR, 8VH, 8VL, 8VQ, 8WO, 8WU, 8XE, 8YM, 8YN, 8YO, 8ZA, 8ZN, 8ZP, 8ZY, 9AAP, 9AAW, 9ACB, 9AF, 9AIR, 9AJA, 9AJU, 9AM, 9AMA, 9AMK, 9AMS, 9AMT, 9ANF, 9AOU, 9AP, 9APK, 9AQE, 9AQM, 9AST, 9ASR, 9AU, 9AV 9AVE, 9AWU, 9AWX, 9AWZ, 9XU, 9AYW, 9AZE, 9BHR, 9CP, 9DCX, 9DEL, 9DKV, 9DLX, 9DMV, 9DPH, 9DV, 9DX, 9DXM, 9ET, 9FS, 9FU, 9GN, 9GP, 9HM, 9HT, 9HU, 9JN, 9JQ, 9KF, 9LW, 9MC, 9ME, 9MI, 9NQ, 9NR, 9OU, 9OX, 9PB, 9PS, 9QR, 9TL, 9TV, 9UH, 9UU, 9VG, 9VV, 9VZ, 9WT, 9WU, 9XA, 9XI, 9XM, 9XX, 9YA, 9YAE, 9YAK, 9YB, 9YM, 9YO, 9ZAC, 9ZB, 9ZC, 9ZH, 9ZJ, 9ZN, Canadian 2CI, 3KG.

C.W.—1AFV, 1BWJ, 1OE, 1TS, 2AWL, 2BGM, 2FD, 2FP, 2XK, 3AHK, 3XM, 4BY, 4GL, 8AWF, 8DE, 8DR, 8VY, 8WY.

1CK, Braintree, Mass.

(1ACO), 1ADL, 1AMD, (1ARY), 1AZK, 1BDC,

1BFZ, (1BIR), 1BJW, (1BLE), 1BVB, 1OE, (1ZE), 2AID, 2AIM, 2AJE, 2ASL, 2AQI, 2AWF, (2BM), (2DN), 2EL, (2FP), 2FL, 2JU, 2OA, (2OM), (2TF), 2UA, 2VA, 2WB, 3ABB, 3ACM, 3AQR, 3BCU, (3CC), 3CG, 3CN, 3DH, 3DW, 3EH, 3HJ, 3HX, 3IW, 3OU, 3PU, 3XM, 4EY, 5DA, (8ACF), 8AFD, 8AGK, 8AJT, 8AHH, (8AFA), 8ALF, 8AOT, 8APA, 8APB, 8AQV, 8AXC, 8AYN, 8BO, 8BQ, 8BRC, 8BUN, 8C,G 8DY, 8EZ, 8HU, 8OI, 8RQ, 8RU, 8RZ, (8SP), 8VQ, 8XE, 8ZD, 8ZN, 8ZR, 9ME, 9TL, 9UH, 9UU, 9ZN.

C.W.—1ANQ, (1AYK), 1CAK, (1TS), 2AJW, 2AWL, 2DN, 2EL, 2FP, 2RU, 2BAK, 3ADT, 3AGL, 3AQR, 3BZ, 3CC, 3ZO, 4GL, 8ACF, 8AJV, 8AWF, 8BK, 8DE, 8DR, 8JQ, 8NQ, 8OW, 8TB, 8VV, 8VY, 8XK, 9AAS, 9AAZ, 9AAW.

1BWD, Calais, Maine.

1AW, 1ARY spk. & C.W., 1AMD, 1ASF, 1APT, 1ADC, 1APO, 1AJP, 1AYL buzzer mod., 1ABY, 1AZW, 1AFV, 1AKB, 1ANY, 1BDI, 1BSD, 1BAD, 1BCX, 1BYX, 1BQL, 1BWA, 1BWI, 1BR, 1BLE, 1BJS, 1BIR, 1BDS, 1BDT, 1BWK, 1BYM, 1BP, 1CIK, 1CAK, 1CDR, 1CCG, 1CAB, 1CDF, 1CF, 1DY, 1FU, 1FD, 1GO, 1GM, 1IA, 1IPE, 1MA, 1OE fone, 1PT, 1PD, 1PY, 1PE, 1QP, 1QN, 1PD, 1RD, 1RV, 1RZ, 1RU, 1SN, 1TS, 1UN, 1UZ, 1UQ, 1XM spk. and ICW, 1XD fone, 1XAD fone, 1XB, 1ZE, 2AKO, 2AWL, 2AJW, 2AJF, 2AJW, 2AB, 2AAX, 2AYV, 2AF, 2AK, 2AJE, 2AFP, 2ANZ, 2AC, 2AXX, 2AGB, 2AJ, 2BGH, 2BML, 2BRC, 2BEB, 2BEH, 2BEA, 2BUA, 2BRB buzzer mod., 2CCL 2DN, 2EL, 2EH, 2FD, 2FM, 2IA, 2JU, 2OM, 2OU, 2QR spk. and C.W., 2RB, 2UD, 2XA, 2XQ fone, 2WL, 2WP, 2VA, 2ZY, 2ZL, 3AGR, 3AJW, 3AAY, 3AFU, 3AML, 3BRC, 3BAG, 3BGH, 3BGM, 3BL, 3CC, 3DO, 3FM, 3GB, 3HJ, 3KM, 3LO, 3LV, 3PB, 3TT, 3WP, 3XA, 3ZA, 3ZV, 3ZU, 4BIY, 4BY, 4BQ, 4ET, 4NX, 8AWP, 8APB, 8AOA, 8AQV, 8ADR, 8BK, 8BEF, 8BCI, 8BNJ, 8BDV, 8DG 8DR 8DD, 8IB, 8JQ, 8JAV, 8KE, 8LX, 8NE, 8OE, 8SEJ, 8UK, 8UJ, 8VY, 8WY, 8XK, 8XU, 8XV, 8ZN, 8ZG, 9AAS, 9AW, 9DT, 9DBQ, 9UU, 9VD, 9XM, NSF fone.

1BOX, Poultney, Vermont

1ABY, 1AC, 1ACG, 1ACO, 1ADL, 1AEV, 1AFV, 1AHF, 1AJR, 1AJS, 1AKA, 1AKO, 1ALK, 1AMD, 1ANQ, 1PO, 1RY, 1ASF, 1ASL, 1ASZ, 1AW, 1AWB, 1AXE, 1AXI, 1AYZ, 1AZQ, 1AZW, 1AZX, 1BCX, 1BDA, 1BDC, 1BDP, 1BEA, 1BES, 1BFK, 1BIR, 1BJE, 1BLE, 1BMY, 1BQE, 1BWJ, 1BWK, 1BYX, 1DH, 1DY, 1FD, 1FV, 1GM, 1IN, 1IA, 1OE, 1PE, 1QN, 1QP, 1QG, 1RU, 1RZ, 1SN, 1TS, 1UE, 1UL, 1UN, 1WP, 1XAD, 1XF, 1YD, 1YK, 1ZE, 2AAB, 2AAX, 2ABD, 2ABQ, 2ABR, 2ADL, 2AFP, 2AGB, 2AHE, 2AHU, 2AIM, 2AJA, 2AJE, 2AJF, 2AJW, 2AKO, 2AWF, 2AWK, 2AWL, 2AWV, 2BDU, 2BEA, 2BEB, 2BEH, 2BG, 2BGH, 2BGM, 2BM, 2BMC, 2BO, 2BOM, 2BQI, 2BRB, 2BRC, 2BSC, 2CE, 2DA, 2DH, 2DK, 2DN, 2DX, 2EL, 2EH, 2FD, 2FP, 2FZ, 2IA, 2LH, 2LK, 2NN, 2OM, 2RM, 2RU, 2WB, 2WP, 2XQ, 3AAE, 3AEV, 3AHK, 3ANU, 3BAG, 3BP, 3BZ, 3CC, 3DH, 3EY, 3FB, 3GE, 3HG, 3HJ, 3HX, 3JL, 3LO, 3MK, 3OU, 3PB, 3RF, 3XM, 3ZO, 3ZZ, 4BY, 4EA, 4GL, 4NX, 4XQ, 4ZL, 5ZA, 6ZA, 8AAZ, 8ACF, 8ADG, 8ADR, 8ADY, 8AFD, 8AGZ, 8AIO, 8ALV, 8AMZ, 8API, 8APT, 8AQV, 8ARW, 8AVQ, 8WF, 8AWP, 8AZZ, 8BCI, 8BDP, 8BDU, 8BF, 8BFG, 8BFX, 8BJ, 8BK, 8BL, 8BNJ, 8BO, 8BOX, 8CG, 8DE, 8DJ, 8DR, 8DX, 8EA, 8GE, 8HU, 8JL, 8JS, 8JQ, 8KM, 8LU, 8LX, 8QU, 8RQ, 8RU, 8RZ, 8SP 8UJ, 8UK, 8VY, 8WY, 8XE, 8XK, 8XM, 8YM, 8YN, 8YO, 8ZD, 8ZG, 8ZY, 8ZZ, 9AAP, 9AAS, 9AJ, 9AJA, 9AL, 9AQZ, 9ARK, 9ASB, 9AW, 9DAB, 9DAH 9HD, 9LQ, 9TL, 9UU, 9XI, 9XM, 9XV, 9YB, 9ZY.

1TS, Bristol, Conn.

Spark: 1ABB, (1ABL), (1ADP), 1AEV, 1AGX, 1AHF, 1AJR, 1AMD, (1ANT), 1APO, (1ARY), (1ASF), 1ASZ, (1AW), (1AXW), 1AYQ, 1AYU, 1AZ, 1AZK, 1BDC, 1BDT, (1BFE), (1BGF), 1BIR, (1BIS), 1BJE, 1BJN, 1BKP, 1BLE, 1BNF, 1BNQ, (1BOQ), 1BRQ, (1BRW), 1BTA, (1BUZ), 1BVB, 1BWY, (1BYM), 1CAC, 1CEO, 1CHI, 1CK (1CKI), 1CM, 1CY, 1DY, 1DZ, 1EP, 1EZ, 1FV, 1GM, 1HK, 1IA, 1MA, (1OE), 1OJ, 1ON, 1PU, 1RV, (1SN), (1SZ), 1UL, 1WR, (1YD), (1ZE), 2AAC, 2ABM, 2ACY, (2AER), 2AHU, 2AID, 2AIM, 2AJA, 2AJE, 2AQI, 2AQL, 2AR, 2ARB, 2ARK, 2ASL, 2AWF, 2BFX, 2BK, 2BM, 2BSC, 2BY, 2CAP, 2DA, 2DK, 2DN, 2DO, 2DR, 2DX, 2EL, 2FP, 2HW, 2JU, 2JW, 2OM, 2PF, 2RM, 2SS, 2SZ, 2TB, 2TF, 2TK, 2TS, 2UA, 2UH, 2WB, 2WM, 2XK, 2XQ, 2ZC, 3AC, 3ACE, 3ACM, 3AGT, 3AHF, 3AHK, 3AIS, 3ALP, 3AQR, 3ARM, 3AUW, 3BFU, 3BG, 3BJP, 3CC, 3CG, 3CM, 3CN, 3DM, 3EH, 3FM, 3FR, 3HG, 3HJ, 3HX, 3IW, 3LP, 3OU, 3PS, 3QF, 3QH, 3QW, 3RW, 3TH, 3UC, 3US, 3VW, 3XM, 3ZA, 3ZF, 3ZO, 4EA, 5XI, 5XU, 5ZAD, 5ZZ, 8ACF, 8ADQ, 8AFA, 8AFD, 8AFG, 8AGB, 8AHS, 8AHU, 8AIG, 8AJV, 8AKQ, 8AMB, 8AMZ, 8AOT, 8APB, 8APP, 8AQD, 8AQV, 8ARD, 8AUY, 8AVD, 8AVQ, 8AVT, 8AWP, 8AXC, 8AXO, 8AXR, 9AYN, 8AYS, 8BBU, 8BDY, 8BEP, 8BFV, 8BP, 8BPT, 8BRL, 8BUK, 8BVA, 8CG, 8DY, 8EA, 8EF, 8EW, 8FI, 8FT, 8GW, 8HG, 8HP, 8HY, 8IN, 8JQ, 8JU, 8KP, 8NO, 8OI, 8PQ, 8PT, 8QC, 8QM, 8QQ, 8RQ, 8RU, 8SP, 8TJ, 8UP, 8VL, 8VQ, 8WO, 8XE, 8XS, 8YN, 8YU, 8ZA, 8ZAC, 8ZF, 8ZN, 8ZP, 9AAP, 9AAW, 9ACL, 9AEG, 9AF, 9AIG, 9AJH, 9ALH, 9AMT, 9AOE, 9APS, 9ASI, 9AU, 9AWX, 9AXU, 9AWZ, 9AYW, 9AZA, 9BDE, 9BHE, 9BHR, 9CP, 9DF, 9DLX, 9DP, 9DWP, 9DXM, 9GM, 9GP, 9GX, 9HM, 9HR, 9JN 9JQ, 9KF, 9LW, 9ME, 9MC, 9OX, 9PL, 9TL, 9UG, 9UH, 9UU, 9UW, 9VA, 9VG, 9WT, 9WU, 9XI, 9XM, 9YA, 9YAC, 9YAE, 9YB, 9YC, 9YM, 9YO, 9ZJ, 9ZN, Canadian 3BP, 3EI, 3GE, 3JL, 3QH.

C.W.—(1ABY), (1AFV), (1AGI), 1AHE, 1AJP, 1AKB, 1ALG, (1ANQ), 1AOL, 1AR, (1ARY), 1AVR. (1AWB), 1AXI, (1AYL fone), (1AZW), (1BCB fone), 1BCF, 1BCG, (1BDI), 1BDS, 1BEA, (1BEP fone), (1BES), (1BGF), 1BIR, 1BJH, 1BKA, 1BLN, (1BMY), (1BOQ), 1BQE, 1BQT, 1BSD, 1BUA, 1BW, 1BWJ, 1BWK, (1BYM), 1BYX, 1CAE, 1CAK, 1CDR, 1CEC, 1CF, 1CGG, 1CGO, 1CGT, 1CKF, 1DH, 1DT, 1EE, 1EP, 1ID, 1IN, (1AE fone), 1PE, (1PT), 1QG, 1QN, 1QP, 1QR, 1RD, (1RU), (1RZ), 1UJ, 1UN, 1UQ, 1XAD fone, 1XG, 1XM, (1YK), (1ZE), 2AAB, 2AAX, 2ABD, 2ABQ, 2ACT, 2ACQ, 2ADL, 2AFP, 2AGB, 2AHL, (2AJF), 2AJR, 2AJW, 2AKL, 2AKO, 2ANZ, 2AQM, 2AQU, 2AWF, 2AWK, 2AWL, 2AWU, 2AYV, 2AYZ fone, 2AXB, 2BAK, 2BB fone, 2BEA, 2BEB, 2BEH, 2BGH, 2BGM, 2BGR, 2BKA, 2BML, 2BND, 2BQH, (2BRC), 2BRE, 2BSC, 2BUA, 2BYS, 2BYW, 2BZY, 2CBG, 2CCL, 2CDA, 2CS, 2DA, 2DN, 2EH, 2EL, 2FD, 2FP, 2FQ, 2FZ, 2GF, 2HI, 2IA, 2KL, 2KP, 2NN, 2QB, 2QR fone, 2RU, 2UA, 2UD, 2VA, (2VH), 2WB, 2WP, 2XD fone, 2XK, 2XQ, 2ZK, 2ZL, 3AAC, 3AAE, 3AAN, 3ABI, 3ADT, 3AEV, 3AHF, 3AHK, 3ANU, 3APQ, 3ARV, 3BA, 3BAG, 3BEC, 3BIY, 3BZ, 3CC, 3DH, 3DR, (3EM), 3FM fone, 3FS 3HJ, 3HX, 3JH, 3MO, 3PB, 3QV, 3RF, 3SQ, 3UH, 3XAA, 3XM, 3ZO, 3ZV, (3ZY), 4BQ, (4BY), 4CO, 4EL, (4GL), 4XC, 4YA, 4ZE, 4ZF, 5DA, 5ZA, 8AC, 8ACF, 8AD, 8ADG, (8ADR), 8ADY, 8AGI, 8AGZ, 8AHR, 8AIO, 8AKE, 8AKJ, 8AKP, 8AKS, 8AMM, (8AMQ fone), 8AND, 8AOA, 8AOG, 8APT, 8AQF, 8AQI, 8AQV fone, 8AQZ, 8AUO, 8AVL, (8AWP), 8AWY, 8BA, 8BEF, 8BEP, 8BFG, 8BFX, 8BFZ, (8BJC), 8BK, 8BLT, 8BLX, 8BMW, 8BNJ, 8BNY, 8BO, 8BOW, 8BOX, 8BQL, 8BRC, 8BRL, 8BRZ, 8BTP, (8BUM), 8BUQ, 8BXA, 8DE, (8DV), 8EA, 8FB, 8FQ, 8GE, 8GV, 8HJ, 8IB, 8II, 8IQ, 8IV, 8JL, 8JQ, 8JS, 8KM, 8KS, 8LB, 8LF, 8LX, (8MF), 8OH, 8OZ, 8QM, 8QY, 8RQ, 8RU, 8SE, 8SP, 8TB, 8UJ, 8UK, 8VY, 8WR, 8WY, 8XH, 8XK, 8XM, 8XV, 8XY, 8ZD, (8ZG), (8ZZ), 9AAS, 9AAV, 9ACO, 9AEJ, 9AFT, (9AJA), (9ANE), 9AMB, 9ARK, 9ASB, 9AVN, 9AXE, 9BED, 9DAB, 9DBQ, 9DWJ, 9EK, 9FM, 9GK, 9HD, 9HY, 9II, 9IO, 9JD, 9LQ, 9NX, 9US, 9VD, 9VK, 9WC, 9XAB, 9XAC, 9XI, 9XM fone, 9ZAE, 9ZAF, 9ZB, 9ZT, Canadian 2BF, (2BG), 3BP, 3NB, 9AW, WL-2, (XF-1), (NMW), NSF, NZO.

2TS, Staten Island, N. Y.

Spark—1ADL, (1AGX), 1AMD, (1ASF), 1AW, 1AZK, 1BDC, (1BIS), 1BLE, 1BLF, 1BVB, 1BVT, 1BWY, (1CY), (1DY), 1HK, 1IA, 1ON, (1RV), (1SN), (1ZE), (2AQL), (2AWF), (2DA), (3AC), 3ACE, (3AHK), 3AIC, 3ALN, (3AQR), 3ARM, (3ARN), 3BEC, 3BG, 3CC, 3CN, 3HJ, 3HX, (3IW), 3OU, 3QF, 3RW, 3TA, (3UC), 3VS, 3VW, 3XF, 3ZA, 4BQ, 4DH, 4EA, 4EY, 4GN, 5DA, 8ACF, 8AFA, 8AFD, 8AFS, 8AHY, 8AJV, (8AJW), (8AMZ), 8AOI, 8APB, (8AQV), 8ARD, 8AYN,

8AYS, 8AWP, 8AXC, 8BA, 8BFV, (8BRL), 8BXC, 8CG, 8CI, 8EA, (8FT), 8HU, 8HG, 8IA, 8IN, 8JQ, 8KU, 8OI, 8RU, (8RQ), 8SP, 8TZ, 8VL, 8VQ, 8WA, 8WZ, 8YN, 9AIR, (9AIU), (9AJH), 9ARG, 9ASJ, 9AU, 9AWX, (9AWZ), 9AXS, 9AXU, 9CP, 9DKV, 9DUG, 9GC, 9MC, 9ME, (9OX), (9TL), 9UH, 9UU, (9ZN), 9ZOR, Can. 3BP, 3JL.

C.W.—(1ES), (1XM), 1XAG fone, 2BSC, (3DH), 3EM, 3ZO, (8AIO), 8AWP, 8DR.

2AQP, New York City

Spark—1AAZ, 1ABB, 1ACD, 1ADL, 1AGX, 1AHF, 1AMD, 1API, 1APO, 1ARK, 1ARY, 1ASF, 1AW, 1AWR, 1AZK, 1AXN, 1AZR, 1AZT, 1BBC, 1BDC, 1BDT, 1BGF, 1BIA, 1BIS, 1BJE, 1BJN, 1BJW, 1BM, 1BOE, 1BPF, 1BRW, 1BVB, 1BWT, 1BWX, 1BWY, 1BYE, 1CBA, 1CCB, 1CM, 1CNT, 1COU, 1CQR, 1DY, 1EZ, 1FQ, 1GM, 1HK, 1HO, 1IA, 1IUF, 1MA, 1OBP, 1OJ, 1PU, 1RO, 1RV, 1SN, 1VY, 1YD, 1ZE, 2BM, 2AWF, 2PV, 2TF, 3AC, 3ACE, 3AHF, 3AHK, 3AIC, 3ALN, 3AQR dalite, 3ARM dalite, 3ARN, 3ATZ, 3AUW, 3BF, 3BFU, 3BG, 3BGT, 3BH, 3BK, 3CC, 3CQ, 3CM, 3CN, 3DM, 3EI, 3GE, 3GX, 3HJ, 3IW, 3KM, 3LP, 3OU, 3QF, 3RT, 3RU, 3RW, 3SB, 3TH, 3UC, 3US, 3VW, 3XM, 3ZA, 4CX, 4EA, 4EY, 4FD, 4GN, 4SC, 5FV, 5ACF, 5AFB, 5AFD, 8AFG, 8AFH, 8AFQ, 8AGB, 8AHU, 8AIG, 8AIH, 8AJE, 8AJO, 8AJT, 8AJV, 8AL, 8AMF, 8AMZ dalite, 8AOT, 8AP, 8APB, 8APP, 8AQ, 8AQV, 8ARD, 8AST, 8ATU, 8AVD, 8AWP, 8AY, 8AYN, 8AYS, 8BCO, 8BDH, 8BDY, 8BFH, 8BHM, 8BN, 8BRB, 8BRL, 8BSY, 8BUN, 8BUT, 8BVA, 8CG, 8DJ, 8DY, 8EW, 8EZ, 8FI, 8FJ, 8FT, 8GR, 8HG, 8HU, 8HY, 8JQ, 8KM, 8MZ, 8NO, 8OI, 8PX, 8QC, 8RQ, 8RU, 8SP, 8TD, 8TJ, 8TK, 8TT, 8TZ, 8UJ, 8UO, 8VL, 8VN, 8VQ, 8VR, 8WA dalite, 8WD, 8WO, 8XE, 8XN, 8XO, 8YN, 8YT, 8ZAC, 9AAW, 9AHY, 9AIR, 9AME, 9ARG, 9ASJ, 9AU, 9AVK, 9AWX, 9AWZ, 9AXU, 9AYM, 9AZE dalite, 9DE, 9CP, 9DXQ, 9ET, 9HB, 9KO, 9LW, 9ME, 9OX, 9PD, 9TO, 9UH, 9UU, 9VG, 9VZ, 9WU, 9ZJ, Canadian 3EI.

C.W.—1ABG, 1AFV, 1AHK, 1AJP dalite, 1AJS, 1AKB, 1AN, 1ANQ, 1ANZ, 1AOL, 1ARY, 1AWB, 1AXV, 1AZW, 1BCG, 1BDI, 1BEA, 1BES, 1BII, 1BQE, 1BSD, 1CAE, 1CEC, 1CF, 1IA, 1IV, 1OK, 1PE, 1PT, 1QN, 1QP, 1TS, 1UN, 1XF, 1XM, 2EH, 2HI, 2XQ, 3AAN, 3AAY, 3ABI, 3AFU, 3AHK, 3APQ, 3AYM, 3BAG, 3BHS, 3BIY, 3BR, 3BZ, 3CE, 3CQ, 3DH, 3EM, 3FP, 3GR, 3HG, 3HJ, 3LV, 3PB, 3QV, 3SJ, 3VS, 3ZO, 3ZY, XF1, 4BQ, 4BY, 4BZ, 4CO, 4FF, 4GI, 4GX, 4NX, 4XC, 5DA, 8AEX, 8AGZ, 8AIX, 8AJP, 8AKJ, 8AOA, 8AOT, 8AQF, 8AQR, 8AVW, 8AWF, 8AWP, 8AWR, 8BCI, 8BJV, 8BK, 8BNJ, 8BO, 8BOX, 8BRL, 8BUM, 8BZC, 8CI, 8DE, 8DOW, 8DR, 8ER, 8FB, 8GE, 8GV, 8HA, 8HG, 8HW, 8IB, 8II, 8IV, 8IQ, 8JL, 8JQ, 8KM, 8LF, 8LX, 8MS, 8RQ, 8RU, 8SP, 8TB, 8UK, 8UJ, 8UZ, 8VJ, 8VQ, 8WR, 8WY, 8XH, 8XK, 8XM, 8XV, 8YG, 8ZD, 8ZZ, 9AAV, 9AJA, 9ALP, 9ARK, 9CI, 9DBT, 9DPO, 9DWJ, 9GC, 9HN, 9RT, 9UA, 9XAH, 9XM, 9ZB, 9ZJ, Canadian 3BP, 9AW, WUBA, NMW.

2AWF, Albany, N. Y.

Spark—(1ACO), (1AEV), (1AMD), (1ARY), (1ASF), 1AZK, 1BDC, (1BIR), (1BIS), 1BRE, 1CM, 1CY, (1DY), (1FV), (1GM), 1HK, 1IA, 1OJ, 1UL, 1XM, 1YD, 1ZE, (2AIM), (2ASL), 2BK, (2DA), 2DN, 2EL, (2JU), 2OA, (2OM), 2RB, (2RM), (2TS), 2TU, 2UA, 2UC, 3AAE, 3ACE, 3AHF, (3AHK), 3AIA, (3ALN), 3AQR, 3BFU, 3BG, 3CC, (3CN), 3DH, 3DM, 3HJ, 3HX, 3IT, 3IW, 3OU, 3PB, 3PU, (3TH), 3VW, (3XM), 3ZO, 4EY, 5DA, 5FJ, 5HK, (8ACF), (8AFB), 8AFD, 8AFG, (8AJK), (8AMZ), (8ANO), (8AOT), 8APB, (8AQV), 8AQZ, 8ARD, 8AWP, 8AXO, 8AYN, 8BA, 8BEP, 8BGJ, (8CG), (8CP), (8DY), 8EW, 8FI, 8HG, (8HP), 8JP, (8JQ), 8JU, 8MS, 8NZ, (8OI), 8PQ, 8PX, (8QC), 8QN, 8RQ, (8RU), 8SP, 8VL, 8VQ, 8XE, 8YM, 8ZA, 8ZD, 8ZR, 8ZW, (9AAP), 9AAW, 9AF, 9AIR, 9AMK, 9AMZ, 9AOM, 9AQM, 9AR, 9ASJ, 9ASR, 9AWU, 9AWX, 9AWZ, 9AYW, 9AZE, 9BDE, 9BEH, 9CP, 9DBJ, 9DXM, (9FS), 9GX, 9JQ, 9MC, (9ME) 9TL, 9UH, 9WU, 9YA, 9YM, 9ZJ, 9ZN, (NZO), XF1, Can. (3BP), (3FO), 3GE, (3JL).

C.W.—(1BEA), 1BDI, 1BOQ, (1BUA), 1TS 1XE, 1XF, 1ZE, 2AFP, 2ANZ, 2BAY, (2BKB), 2BML, 2CBC, 2DB, 2FP, 2FZ, 2XB, 2XK, 3BIY, 3BZ, 3CC, 3ZO, 4BQ, 4BY, 4EL, 4GL, 9AJA, 9ARK, 9LY, KDKA, WJZ, WL2, XF1.

2DX, Summit, N. J.

Spark—1AW, 1CJ, 1CM, 1CY, 1DY, 1DZ, 1FG, 1GM, 1IA, 1IN, 1MA, 1OE, 1OJ, 1RV, (1RX), 1SN, 1TK, 1ZE, 1ZY, 1AAU, (1ACO), 1ADC, 1ADL, 1AHF, 1AMD, (1ARY), (1ASF), 1ASL, (1AZK), 1BDC, 1BDT, 1BIR, 1BIS, (1BJE), 1BRW, 1BVB, 1BWB, 1BWY, 1CHJ, 2CG, 2SQ, 2XQ, 2AID, (3AC), 3BG, 3CG, 3CN, 3DM, 3EH, 3HJ, 3HX, 3IW, 3JL, 3OB, 3OU, 3QP, 3RW, 3TH, 3TJ, 3UC, 3VM, 3VW, 3XF, (3XM), 3ZA, 3AAG, 3ACE, (3AHF), 3AHK, 3AIC, 3AIY, 3ALN, 3AQR, 3ARN, (3ATZ), 3AWH, 3AZN, 3BFU, 4AL, 4CX, (4EA), 4EY, 4FD, 4GN, 5AS, 5FJ, 5XA, 5XK, 8AL, 8BA, 8CF, 8DJ, 8DY, 8DZ, 8EF, 8EP, 8EW, 8EZ, 8FE, 8FI, 8FO, 8FS, 8FT, 8GW, 8HA, 8HF, 8HG, 8HP, 8HU, 8IL, 8IQ, 8JQ, 8JP, 8JU, 8MO, 8NA, 8OI, 8PM, 8PX, 8QM, 8RQ, 8RU, 8SP, 8SU, 8TC, 8TK, 8UC, 8UL, 8VL, 8VQ, 8WA, 8WO, 8XD, 8XE, 8XU, 8YN, 8ZD, 8ZN, 8AAV, 8ACC, 8ACF, 8ACL, 8AER, 8AFA, 8AFB, 8AFD, 8AHU, 8AIO, 8AJB, 8AJF, 8ALE, 8ALH, 8AMB, 8AMK, 8AMP, (8AMZ), 8ANO, 8AOT, 8APA, 8APB, 8QN, 8AQV, 8ARB, 8ARD, 8AUD, 8AYS, 8BDG, 8BEN, (8BFV), 8BGJ, 8BVA, 9AF, 9BD, 9CP, 9DB, 9HS, 9JN, 9JQ, 9LF, 9MC, 9ME, 9TL, 9UH, 9UU, 9VG, 9WK, 9YB, 9ZJ, 9ZX, 9AAP, 9AAW, 9ACJ, 9ACN, 9AFK, 9AGR, 9AIF, 9AIR, 9AJH, 9AQA, 9ASJ, 9AWX, 9AWZ, 9BDE, 9BDS, 9DXM, 9DYU, Canadian (3BP), 3BE, 3JL,

C.W.—1AR, 1CZ, 1ON, 1QN, 1QP, 1QR, 1RU, 1TS, 1UN, 1XF, 1XM, 1AFV, 1AKB, 1ARY, 1AWB, 1AZW, 1BCG, 1BDA, 1BDI, 1BES, 1BUA, 1CAE, 1CGG, 3BZ, (3DH), 3MO, 3NH, 3PB, 3ZA, 3ZN, 3ZO fone, 3ZY, 3AAE, 3AAN, 3AHK, 3AQR, 3BAG, 4BY, 4GL, 8BO, 8CG, 8GE, 8II, 8NV, 8SP, 8OJ, 8UK, 8VY, 8XK, 8XL, 8XV, 8ZD, 8ZG, 8ZZ, 8AMQ, 8AQG, 8AWP, 8BFX, 8BFZ, 8BOX, 9HD, 9LQ, 9AAS, 9AJA, 9ARK, Canadian: 3BP, 9AW.

Heard in full dalite—1FG, 1MA, 1RV, (1RX), 1AAU, 1ADC, 1ASL, (1AZK), 1BVB, 3CG, 3IW, 3TJ, 3AIS, 3ALN, 8FO, 8FT, 8RQ, 8AAV, 8AFA, 8AFD, 8AMZ, 8ARD, 8BP (Can.)

A. L. Groves, Brooke, Va.

Spark—1AW, 1AZ, 1FV, 1HK, 1IA, 1JE, 1MA, 1RU, 1YD, 1ZE, 1ADL, 1AEV, 1ARY, 1BCF, 1BCD, 1BDU, 1BFZ, 1BIR, 1BJS, 1BLE, 1BNR, 1BRW, 1BVA, 1BVB, 1BWY, 1CHJ, 2AW, 2BG, 2BK, 2BM, 2BP, 2CM, 2DA, 2DD, 2DK, 2DN, 2DR, 2DX, 2FC, 2FP, 2JU, 2MV, 2OA, 2OK, 2OM, 2OO, 2QC, 2QV, 2QW, 2RM, 2TJ, 2TS, 2UC, 2UE, 2VA, 2WB, 2WM, 2XJ, 2XK, 2XM, 2XQ, 2ZR, 2ACD, 2ACY, 2AER, 2AHK, 2AHU, 2AIC, 2AID, 2AIM, 2AJA, 2AKH, 2ARD, 2ARK, 2ASL, 2AUY, 2AWF, 2BJO, 2BJP, 2BNL, 2BSC, Canadian 2BF, 3AC, 3AI, 3BC, 3BF, 3BG, 3BJ, 3BS, 3BW, 3CC, 3CG, 3DM, 3EH, 3FM, 3HJ, 3IQ, 3IS, 3IT, 3IW, 3KM, 3KN, 3LP, 3LU, 3MZ, 3PL, 3PU, 3QN, 3QW, 3RI, 3RI, 3TA, 3UC, 3UQ, 3US, 3VW, 3WU, 3WX, 3XF, 3XY, 3YO, 3ZA, 3ZO, 3ZV, 3ZZ, 3ACE, 3ACN, 3ADB, 3AHF, 3AHK, 3AHS, 3AIA, 3AIC, 3AIS, 3ALN, 3AMV, 3AQR, 3ARO, 3AVS, 3BFS, 3BFU, Canadian 3BP, 3FO, 3JL, 4BQ, 4BY, 4CG, 4DH, 4EA, 4EN, 4FD, 4GF, 4GN, 4GU, 4GX, 4XK, 4YA, 5AA, 5DA, 5ER, 5FD, 5FJ, 5FP, 5FV, 5HK, 5JA, 5JD, 5JH, 5XA, 5XK, 5XP, 5XU, 5ZL, 5ZZ, 5ZAB, 8AL, 8AR, 8AX, 8BA, 8BK, 8BM, 8BP, 8BR, 8BX, 8CG, 8CP, 8CR, 8DY, 8DZ, 8EA, 8EF, 8EO, 8ER, 8EW, 8EZ, 8FD, 8FI, 8FQ, 8FT, 8GW, 8HA, 8HF, 8HJ, 8HU, 8HY, 8IN, 8IO, 8IZ, 8JB, 8JK, 8JQ, 8JU, 8LH, 8MW, 8MZ, 8NO, 8NZ, 8OE, 8OI, 8PQ, 8QM, 8QR, 8RG, 8RQ, 8RS, 8RU, 8SP, 8TK, 8TT, 8UH, 8VQ, 8WD, 8WN, 8WO, 8WZ, 8XE, 8YM, 8YN, 8YO, 8ZA, 8ZB, 8ZG, 8ZN, 8ZY, 8AAJ, 8AAU, 8AAV, 8AAZ, 8ABP, 8ACF, 8ACL, 8ACP, 8ACY, 8ADH, 8ADK, 8ADQ, 8AFA, 8AFB, 8AFD, 8AFG, 8AFM, 8AFO, 8AGB, 8AHO, 8AHS, 8AHY, 8AIN, 8AIZ, 8AJK, 8AJW, 8AKV, 8AKW, 8AKY, 8AMB, 8AMD, 8AMF, 8AMP, 8AMZ, 8ANB, 8ANY, 8AOI, 8AOT, 8AOX, 8APA, 8APB, 8APP, 8APW, 8AQA, 8ARD, 8ASJ, 8ASZ, 8ATU, 8AUE, 8AWR, 8AWU, 8AXN, 8AXO, 8AYE, 8AYN, 8AYS, 8BDB, 8BDN, 8BDY, 8BEB, 8BEN, 8BEP, 8BEW, 8BFA, 8BFV, 8BGJ, 8BHV, 8BKN, 8BOC, 8BOY, 8BQO, 8BRL, 8BSY, 8BUN, 8BVA, 8BWC 8BVB 9AF, 9AS, 9AZ, 9CP, 9DY, 9FB, 9FD, 9FS, 9GW, 9GX.

9HR, 9HT, 9IO, 9JD, 9JQ, 9MC, 9ME, 9OF, 9OI, 9PC, 9PD, 9QC, 9QH, 9TO, 9TV, 9UC, 9UG, 9UH, 9UR, 9VG, 9VQ, 9YB, 9YM, 9YN, 9YO, 9ZN, 9AAS, 9AAW, 9ABH, 9ABS, 9ACN, 9AFJ, 9AGQ, 9AGR, 9AHI, 9AHJ, 9AIJ, 9AIN, 9AIR, 9AJA, 9MV, 9AOU, 9AQE, 9ARG, 9ARR, 9ASJ, 9ASP, 9ATU, 9AUW, 9AWA, 9AWN, 9AWU, 9AWZ, 9AXS, 9AXU, 9AYH, 9AZE, 9BDE, 9BDS, 9CAN, 9DBU, 9DBW, 9DEL, 9DKV, 9DMJ, 9DQQ, 9DTJ.

C.W.—1ID, 1QG, 1QP, 1RU, 1RZ, 1TS, 1UN, 1XM, 1ZE, 1ZP, 1AAZ, 1AJP, 1AWB, 1AZW, 1AZX, 1BIR, 1BQE, 1BUA, 1CJH, 2CC, 2DH, 2EH, 2FD, 2FP, 2KL, 2OM, 2UD, 2VH, 2WB, 2WL, 2WP, 2XQ, 2XK, 2AAB, 2AAX, 2ABD, 2ACO, 2AFP, 2AGB, 2AJF, 2AJW, 2AVU, 2AWL, 2AWK, 2AXB, 2AYZ, 2BCD, 2BGM, 2BIV, 2BML, 2BRB, 2BRC, 2BSC, 2BUA, 2BYC, 2BYS, 3BA, 3BZ, 3CA, 3CC, 3CW, 3DH, 3HG, 3LH, 3PB, 3RF, 3RT, 3SQ, 3TJ, 2VX, 3ZO, 3ZY, 3ZZ, 3AAN, 3AAT, 3AEV, 3AHK, 3AJB, 3AQR, 3AWI, 3BAG, 3BEC, 3BIY, 4BK, 4BQ 4EL, 4EN, 4GL, 4GX, 5DA, 8BA, 8BK, 8CF, 8CI, 8DE, 8DP, 8EA, 8FB, 8GE, 8GV, 8HJ, 8IV, 8IQ, 8JS, 8LJ, 8LW, 8LX, 8OH, 8QM, 8QY, 8RU, 8SP, 8TT, 8UJ, 8VJ, 8VY, 8WY, 8XM, 8ZD, 8ZG, 8ABO, 8ACF, 8AGG, 8AIO, 8AOA, 8AOG, 8AQF, 8AQZ, 8BDU, 8BFX, 8BDU, 8BHX, 8BIC, 8BLT, 8BNJ, 8BOW, 8BOX, 8BRX, 8BUM, 8BZC, 9AS, 9II, 9IO, 9JD, 9LQ, 9QJ, 9RT, 9US, 9ZJ, 9ZY, 9AAS, 9AJA, 9AKD, 9AQR, 9BAP.

3ZY, Washington, D.C.
October 15th to November 15th, 1921

C.W.—1IN, 1MB, 1QN, (1TS), 1UN, 1AFV, 1AGI, (1ANQ), 1ARY, 1BAI, 1BEP, (1BES), 1BDE, (1CAE), 1CAK, 1CGG, (2DN), 2EL, 2FD, 2FP, 2KL, 2NN, 2OE, 2VH, (2WP), 2XA, 2YM, 2ZE, (2ZL), 2ZV, 2ABR, 2ADL, (2AFP), 2AKO, (2AWL), 2AXB, 2AYZ, 2BAK, 2BEA, 2BGH, 2BGM, 2BQH, 2BRB, 2BYS, 3BA, (3BP Can.), (3BZ), 3CA, 3CC, (3EM), 3FM, (3GB), (3HJ), (3HG), 3HX, (3MO), 3PB, (3PU), 3QV, (3RF), 3SQ, 3WP, 3ZN, (3ZZ), (3AAE), 3AAY, (3AHK), 3AQR, 3ASW, 3BEC, 3BIY, (3XAA), 4BD, (4BY), (4CO), (4EL), 4EN, (4FF), (4GL), 4HW, 4II, 4LE, 4ZE, 5DA, 5LA, 5XA, 5ZA, 8AC, 8BA, 8BO, (8DE), 8DR, 8DX, (8DZ), 8EA, (8FB), (8GE), 8GV, 8IA, (8IB), 8II, 8IQ, 8IV, (8JL), 8JQ, 8JS, (8LX), 8OH, 8PD, 8PX, 8QM, 8QU, (8QY), 8RY, phone, (8SE), 8SP, 8TG, 8TN, 8UJ, (8UK), (8VJ), (8VY), (8WY), (8XM), 8XY, (8ZD), 8ZZ, 8ABO, 8ADY, 8AFG, 8AIO, 8AJT, 8AKE, 8AKJ, 8AKP, 8APT, 8AQF, (8AQZ), (8AWP), 8BDU, (8BEF), 8BFG, 8BFX, (8BFZ), 8BJV, 8BNJ, 8BOW, (8BOX), 8BRL, (8BUM), 8BHX, 9AA, 9AW Can., (9HD), 8HY, 9IO, 9JR, 9LQ, 9RT, (9UC), (9VG), 9XI, 9ZB, (9ZJ), 9AAV, (9AJA), 9AKD, 9AMB, (9ARK), 9XAH, 9ZAC, (NMW), (NX4), (XF1).

3ZA, Bala, Penna.

Spark—(1AW), (1DY), 1HK, (1IA), 1OJ, 1PU, (1SN), 1AMD, (1ASF), 1BDC, 1BER, 1BVB, 1CHX, (2BK), 2BM, (2CY), 2DA, (2DK), (2DN), (2DO), 2DR, 2FD, (2FP), (2GK), 2IA, 2JL, 2JU, 2OE, (2OM), 2RM, 2SQ, 2TF, 2TS, 2UA, (2UD), 2UE, 2WB, 2WM, 2XK, (2AID), 2AJE, (2AQL), 2ARB, 2ARY, 2ASL, (2AUY), 2BJO, 2BSC, 3CG, (3DH), 3HG (3IW), 3KM, 3OU, 3SQ, 3US, (3XF), (3ZO), 3ZY, 3AHF, (3AHK), 3AIC, 3ALN, 3AQR, 3ATZ, 3BJT, 4AG, 4CG, 4EA, 5HK, 5XA, 8AL, 8AU, 8BA, 8CI, 8DE, (8DY), 8EA, 8EW, 8EZ, 8FT, 8HS, 8HU, 8HY, 8IL, (8IN), 8JQ, (8JU), 8KL, 8PX, 8QQ, (8RQ), (8RU), 8TK, 8UO, 8VK, 8VL, 8VQ, (8WO), 8WY, (8XE), 8YM, 8ZA, (8ACF), (8AFD), 8AGK, 8AHU, 8AJW, 8AMB, (8AMZ), 8ANY, (8AOI), 8AQV, 8ARB, 8ARD, 8ASR, 8ASZ, 8AYN, 8BBU, 8BDY, 8BFH, (8BRL), (8BVA), 9AU, 9CP, 9DJ, 9CG, 9HM, 9KO, 9PC, 9RT, 9TL, 9UH, 9VG, 9XM, 9ZB, 9ZN, 9AAS, 9AAW, 9AFK, 9AGR, 9AIK, 9AIR, 9ARG, 9ASG, 9ASJ, 9AIU, 9AWX, 9AWZ, (9AZE), 9BDE, 9BDS, 9BED, 9DKV, 9DLX, 3BP (Can.), 3GN (Can.), 3JL (Can.)

C.W.—1ID, (1PE), 1TS, 1XM, (1AFV), 1BEA, 2FD, (2FP), 2FZ, (2KL), 2RP, 2WP, 2XQ, 2ZL, (2AAX), 2ACQ, 2AJF, 2AML, (2AWL), 2AYZ, (2BRO), 2BSC, (3EM), 3RO, (3XM), 3BIY, 4BY, 4GL, 8BA, 8IB, 8II, 8JQ, 8JU, 8RU, 8SP, 8TN, 8UJ, 8XK, 8XM, 8ZZ, 8ACF, 8AGZ, 8AKE, 8AND, (8AWP), 8BDU, (8BRL), 8BUM, 9DAB, 9DAH, (XF1).

3AIH, West Philadelphia, Pa., One Tube.

Spark—1AW, 1FV, 1GM, 1HK, 1HO, 1IA, 1RV, 1YD, 1AMD, 1ARY, 1BDC, 1BDT, 1BGF, 1BIS, 1BLE, 1BVB, 1CAC, 2BK, 2BL, 2BM, 2CY, 2DA, 2DK, 2DN, 2FP, 2JU, 2OM, 2TF, 2TS, 2WM, 2AHU, 2AID, 2AIM, 2AWF 3IW, 3ACE, 3AIC, 3AQR, 3ARU, 4DH, 4EA, 4GN, 5FV, 8CG, 8CI, 8DJ, 8DY, 8EA, 8EW, 8EZ, 8FI, 8FT, 8HG, 8HU, 8JQ, 8QM, 8RQ, 8SP, 8TZ, 8WD, 8WO, 8WZ, 8XE, 8YN, 8ZA, 8ZN, 8ACF, 8AFA, 8AFD, 8AFG, 8AJW, 8AMZ, 8AOT, 8APB, 8AQV, 8ARD, 8AXN, 8AXO, 8AYN, 8AYS, 8BAH, 8BDY, 8BRL, 8BUH, 8BVA, 9AF, 9CP, 9FD, 9MC, 9PC, 9TL, 9UH, 9UU, 9WT, 9YB 9ZJ, 9ZN, 9AAP, 9AAW, 9AGR, 9AIR, 9AMT, 9AOX, 9ASJ, 9AWX, 9BDE, 9DBU, 9BCX, 9DXM, Canadian 3BP, 3GE, 3JL.

C.W.—1PE, 1QN, 1QP, 1QR, 1RU, 1TS, 1UN, 1XM, 1AFV, 1AGI, 1AJP, 1ANQ, 1ARY, 1AZW, 1BDI, 1BGF, 1BQE, 1BWK, 1BYX, 2EH, 2EL, 2FD, 2FP, 2IA, 2KL, 2ZL, 2AAX, 2AFP, 2AGB, 2AJF, 2AJW, 2AQI, 2AWL, 2AYZ, 2BEA, 2BGH, 2BGM, 2BRB, 2BSC, 2BYS, 2BZY, 3BZ, 3CA, 3MO, 3TJ, 3ZO fone, 3ZY, 3ABI, 3AHK, 3BCN, 4BQ, 4BY, 4EN, 4GL, 4GX, 4LI, 8BK, 8DE, 8DR, 8DX, 8EA, 8GE, 8II fone, 8IQ, 8JL, 8KM, 8OH, 8SE, 8TF, 8UJ, 8UK, 8VJ, 8VY, 8WY, 8XK, 8XM, 8ZD, 8ZG, 8ZZ, 8ABO, 8ADR, 8AHZ, 8AOA, 8APT, 8AQF, 8AWP, 8AXC, 8BEF, 8BET, 8BNJ, 8BOX, 8BRL, 9ZY, 9AAS, 9AJA, 9ARK, 9DWJ, NX4, XF1, Canadian 9AW.

4FR—Tampa, Fla.

Spark—(4AS), (4BC), 4BQ, 4CX, 4DH, 4EA, (4FD), (4GN), 4GU, 5AA, 5BM, 5EK, (5XA), 5XB, 5XJ, 5XU, 5YL, 5ZA, 5ZAB, 5ZL, 5ZX, 8YO, 9DQQ, 9GN, 9MC, 9SP, 9ZJ, NSF.

C.W.—2AWL, 2ZL, 3ZY, 4BQ, 4BY, 4GL, 4CD, 4EL, 4LE, 4XC, 5DA, 8BFX, 8II, 8YO, 8ZG, 9AS, NX4, XF1.

4AG, Athens, Ga.

Spark—2AIM, 2BK, 2DA, 2DR, (2DN), 2EL, 2FJ, 3AQR, 3ACE, (3AHC), 3BBE, 3BG, 3EM, (3HJ), 3KH, 3TA, 3XF, 3ZY, 4AS, 4BY, 4CQ, (4EA), 4FG, (4FD), 4GN, 4YA, (5DA), (5ER), 5ED, 5EN, 5EK, 5FV, 5HK, 5JD, 5RZ, 5XS, 5YE, 5ZAA, 5ZL, 8ALV, 8ARD, 8AY, (8AYN), 8ASZ, 8AIZ, 8AQV, 8AFD, 8AFB, 8AJW, 8AXC, (8ANO), 8AWZ, (8BBU), 8BRL, 8BVA, 8BR, (8BDY), 8DZ, 8EZ, 8EA, (8EB), 8FJ, 8FI, (8FT), 8GW, (8HU), 8JN, 8JQ 8JA, 8RQ, (8SP), 8TK, 8UX, 8VJ, (8UQ), 8WZ, 8XE, 8YN, 8YM, 8ZAA, 8ZA, 8ZB, 8ZR, 8ZD, 9AH, 9AF, 9AYH, 9AZ, 9AAU, 9AQE, 9AAW, (9ARI), 9ASJ, 9AKW, 9AUU, (9AMT), 9AXU, 9AEY, 9ASG, 9AU, 9AIR, 9AWJ, 9AEG, 9AWZ, (9BDE), 9DYU, 9DZ, 9ET, 9HR, 9HN, 9JN, 9LF, 9LR, 9MC, 9MGR, 9MH, (9OX), 9PC, 9RY, 9TL, 9UU, (9UH), 9VL, 9VV, 9VQ, 9VZ, 9YA, 9ZJ, 9ZAC, (9ZN), (9ZB).

C.W.—2BQ, 2FP, 2FD, 2MV, 3DH, 3ZZ, 4BK, 4BY, 4GL, 4XC, 8AWP, 8BOX, 8LQ, 9AAS, 9AJA, 9BAP, 9NY, WL2.

Worked by 4BQ—Rome, Ga.

Spark—2FP, 2MB, 3BP, 3BZ, 4FD, 4GN, 5HR, 5HK, 5HZ, 5ZL, 5YH, 5LA, 5YE, 5EK, 5FV, 8AAS, 8AP, 8KH, 8ASZ, 8GX, 8RQ, 8LZ, 8ZD, 8FJ, 8BBU, 8AIB, 8EC, 8ANO, 8FT, 8ACF, 8ACY, 8AFS, 8BUC, 8AEG, 9RY, 9ARO, 9AGN, 9AGR, 9FS, 9HR, 9RCY, 9PC, 9AWC, 9AIO, 9MC, 9AQM, 9KO, 9ASJ, 9VZ, 9APS, 9GX, 9OX.

C.W.—3MO, 5ZL, 8WY, 8XY.

Worked by 4DH, LaGrange, Ga.

Spark—2FP, 3EZ, 3IW, 3AQR, 4AS, 4BY, 4CX, 4EA, 4FD, 4GN, 4ZC, 5AA, 5BM, 5DA, 5FV, 5HK, 5LX, 5NK, 5NS, 5QA, 5XA, 5ZT, 5ZAB, 8EA, 8FT 8OI, 8UC, 8ADE, 8AFS, 8AOI, 8ARD, 8ARS, 8BOX, 8AYN, 8ZAA, 9CP, 9GX, 9ME, 9OX, 9UH, 9UU, 9ZN, 9AFF, 9AGR, 9ALU, 9AMA, 9ASJ, 9AWZ, 9BDE, 9DMJ, 9DUG, 9DQQ, 9DYN, 9UTZ.

C.W.—2FP, 5DA, 8II, 8UJ, 8AXK, 9HK.

4XC, Atlanta, Ga.

Spark— 2BK, 2EL, 2MB, 2FP, 2WB, 3ALN, 3AQR, 3IW, 3OU, 3XM, 4AG, 4CX, 4FD, 4GN, 4EA, 4DH, 5AA 5BM, 5DA 5EK, 5FJ, 5FO, 5FU, 5HK, (5HZ), 5IR, 5JD, (5ER), 5NC, (5QA), 5SM, (5XA), 5XB, 5XK, 5XU, 5YE, 5YL, 5ZAA, 5ZAG,

5ZAK, 5ZAB, 5ZL, 8AYN, 8ARD, 8ACF, 8AFD, 8AGK, 8AJW, 8AFB, 8BEF, 8BSQ, 8BBU, 8BVA, 8BSY, 8BEP, 8BA, 8CI, 8DZ, 8EB, 8EZ, 8FA, 8HU, 8JQ, 8JU, 8NZ, 8PB, 8RQ, 8SP, 8TK, 8UG, 8VG, 8WR, 8XE, 8YN, 8YU, 8ZA, 8ZAA, 8ZY, 9AU, 9AF, 9AXU, 9AQM, 9AAP, 9AAY, 9ARI, 9AQE, 9ASJ, 9AEY, 9AIR, 9ACN, 9AYW, 9AVE, 9AOU, 9AWX, 9ACW, 9ARG, 9ACB, 9AQR, 9AXU, 9BDE, 8BRL, 9CP, 9DLS, 9DXM, 9DWM, 9DMJ, 9ET, 9FM, 9FU, 9HR, 9HI, 9JQ, 9KO, 9KF, 9LF, 9MC, 9ME, 9NR, 9OU, 9QX, 9PS, 9UA, 9UW, 9UU, 9VG, 9VZ, 9UH, 9VV, 9WH, 9WT, 9XM, 9YA, 9YB, 9YAE, 9YAK, 9YM, 9YO, 9ZJ, 9ZN, Can. 3BP, 3EI.

C.W.—1AZW 1ARY, 1AJP, 1AFV, 1BWK, 1TS, 1UN, 1XM, 2AWL, 2AFP, 2AWA, 2AYV, 2AWU, 2AWX, 2AXX, 2AKO, 2BML, 2BQI, 2BFZ, 2BAD, 2BZC, 2BSC, 2CCL, 2EH, 2FD, (2EL), 2KL, 2XA, 2XMA, 2ZL, 3AAE, 3AAN, 3ABI, 3AEV, 3AHK, 3BA, 3BZ, (3BIY), 3BAG, 3CW, 3EM, 3FS, 3GB, 3HX, (3MO), 3PB, 3RF, (3ZO), 3ZY, 3ZZ, (4BQ), 4BY, 4EL, 4EN, (4GL), (4GX), (4II), 4JH, 4LE, 4ZE, (5LA), (5XA), (5YI), (8ACF), 8AQF, 8AWP, 8AIO, 8AQI, (8AXK), 8AQV, 8AOA, 8AOG, 8ALV, 8APT, (8BOX), 8BJV, 8BFX, (8BRL), 8BCI, 8BA, (8BK), 8BOW, 8BXA, 8BZC, 8CI, 8BR, 8EA, 8GV, 8HM, 8IV, (8II), 8IB, 8IQ, (8JL), 8LF, 8LX, 8RU, 8UK, (8UJ), 8UZ, (8VY), 8VJ, 8WR, 8WY, 8XK, 8XV, 8ZG, 8ZU, 8ZZ, 9AW, 9ALK, 9AJA, 9ANE, 9AKO, 9AAS, 9AKR, 9ANR, 9AAV, 9BBF, (9BED), (9DWJ), (9FM), (9IQ), (9LQ), 9NX, 9RT, 9RV, 9UU, 9VE, (9VG), 9XM, 9XAC, (9XAH), 9XAE, 9XI, (9ZB), 9ZJ, (9ZV), Canadian: 3BP, 9AW, NSF, NZO, NX4, (XF1), XF3, (WL2), WUBC.

5AK—Camp Travis, Tex.

Spark—(4DH), 4YA, 5AA, (5AE), 5AO, 5BI, 5BM, (5CA), 5CI, 5CL, (5EK), (5EW), (5FA), 5FI, (5FO), 5HJ, (5HK), (5HZ), 5IB, 5IC, 5IF, 5IQ, (5IR), 5IS, (5JD), (5JI), 5JL, 5KC, (5KP), 5LC, (5LX), 5MK, (5MT), 5NC, (5NK), 5NS, 5OD, 5OF, 5PX, 5QA, (5QI), 5QQ, (5QS), 5QY, (5RA), 5SM, (5TG), 5TP, (5XB), (5XJ), 5XT, (5XU), 5YE, (5YK), 5YL, 5YI, 5YM, (5YN), 5ZA, (5ZAA), (5ZAB), 5ZAF, (5ZAG), 5ZC, (5ZE), 5ZF, 5ZL, (5ZN), (5O), 5ZS, (5ZU), 5ZW, (5ZX), 6FK, 6ZZ, 9ABV, 9ACL, 9ANF, 9AMA, 9AMK, 9AMS, (9AQE), 9AEG, 9AEQ, 9AYW, 9AUO, 9AXU, 9AWX, 9AVE, 9AJS, 9DUG, 9DSD, 9DQQ, 9DEH, (9EL), 9FU, 9HI, 9HT, 9JQ, 9JN, (9LW), 9MC, (9NR), 9OI, 9QM, 9RV, 9RY, 9WI, 9WT, 9WU, 9XK, 9YA, 9YAK, (9YAE), 9YB, 9YJ, (9YMA), (9YO), 9ZAC, 9ZAF, 9ZH, 9ZJ, 9ZN.

C.W.—2ZL, 3ZL, XF1, (5MT), 5ZA, (5ZAG), 5ZS, 6WV, 8XY, 9AAS, 9AMB, 9FM, 9LY, 9NX, 9XI, 9ZAF.

5RJ, Norman, Okla.

5XT fone, 5CF, 5CQ, 5FO, 5EK, 5HA, 5HK, 5HZ, 5IF, 5IN, 5OH, 5QA, 5QC, 5TJ C.W., 5XJ QSA, 5XT, 5ZA, 5ZZ, 5ZW, 9AFO, 9AGR, 9AIF, 9AM, 9AMA QSA, 9AN, 9DXM, 9DYM, 9DZ, 9GP, 9KP, 9LD, 9QQ, 9RY, 9YO.

5ZAF, Waco, Texas

Spark—5AA, (5AO), (5BM), 5DP, (5FA), (5FO), (5HK), (5HZ), (5IB), (5IR), (5JD), 5JI, (5JR), 5KC, (5KP), 5LB, (5LM), 5LO, 5LX, (5MM), (5MX), 5NK, 5OF, (5PP), (5QS), (5QT), 5RA, 5UI, (5XB), (5XI), (5XJ), 5XT, (5XU), (5YK), 5YL, 5YN, (5ZA), 5ZC, 5ZE, (5ZF), 5ZJ, (5ZL), 5ZN, 5ZO, 5ZS, (5ZU), 5ZV, 5ZW, (5ZAB), (5ZAG), 5ZAK, 5ZAM, 6ZZ, 9DS, 9EL, 9EY, 9FZ, 9HI, 9MC, (9PS), 9WI, 9XM, 9YA, 9YM, 9YN, 9YO, 9YAE, 9YAK, 9ZJ, 9ZN, 9ZAC, 9ACL, 9AEL, 9AEG, 9AEY, 9AMA, 9AQE, (9AUO), 9AVE.

C.W.—(5CI), 5JL, 5XC, 6JF, 9ZY, 9ZAF fone, 9ABV, WRR fone.

5XA, Auburn, Ala.

Spark: 2BK, 2DH ICW, 2EL, (2FP), 2TJ, 2ALN ICW, 3DH, (3HJ), (3ACE), (3AQR), 3BFU, 4AG, 4AS, (4BK), 4BM, 4CX, (4DH), 4EA, (4FD), 4FF, (4FR), (4GN), 4GT, (4YA), (4ZC), (5AA), 5DA, (5EK), 5ER, (5FV), (5HZ), 5IF, (5IR), (5JD), 5JI, 5JL, 5JR, (5LX), 5NK, 5QA, 5QI, 5XJ, 5XK ICW, 5XU, 5ZA, (5ZL), (5ZAB), 5ZAL, (5ZAM), 6WV, 8BR, 8DE, (8FT), 8HU, 8HY, 8JQ, 8NZ, 8OI, (8RQ), 8UC, 8UU, 8XE ICW, 8XK, 8YM, 8YN, 8ZD, 8ACF, 8AFD, (8AFG), 8ASV, 8AND, 8AQV, (8ARD), 8ASZ, 8AXC, 8AYN, 8BEP, 8ZAA, (9CP), 9ET, 9FA, 9FU, 9HH, 9HI, 9HR, 9JQ, 9KO, (9KR), (9LF), (9LQ), 9MC, (9OX), (9PS), 9QJ, (9RY), 9TQ, 9TV, 9VQ, (9UH), (9UU), (9VG), (9XO), 9YM, 9ZJ, 9AAP, (9ALG), (9AMA), 9AMK, 9AMV, (9ANO), (9AQM), (9ARG), (9ARM), 9ARX, 9ASF, (9ASJ), 9ASN, 9AYM, (9BDE), (9BDS), (9BDU), 9DMW, (9DQQ), 9DSD, 9DUD, 9DUG, 9DYU, 9SEN.

C.W.—1RU, 2AW, 2FD, (2FP), 2PD, 2ZL, 2ZV, 2AWL, (3BZ), 3FS, 3MO, 3RF, 3RU, 3ZY, 4AG, 4BQ, (4BY), 4CF, 4EB, (4GL), 4II, 4LE, 4RD, 5DA, 5LA, 8AW, 8DE, 8DR, 8GE, 8II, 8IZ, 8JP, 8LX, 8UJ, 8UK, 8VJ, 8VY, 8ACF, 8AQF, 8AWP, 8AZF, 8BCI, (8BOX), 8BFX, 8BSY, 9IO, 9RT, 9UU, (9ZB), 9ZY, 9AAS, 9AJA, Canadian 3BP.

6BF, Santa Paula, Calif.

5ZA, 6AK, 6BB, 6CZ, 6EA, 6EX, 6FD, 6GF, 6GP, 6GR, 6GX, 6IC, 6IG, 6IS, 6IV, 6JW, (6JX), 6KC, 6KM, 6KS, 6KY, 6LC, 6LU, 6MB, 6MH, 6MF, 6MZ, 6OC, 6OD, 6OH, 6OL, 6OM, 6OO, 6PJ, 6PO, 6QC, 6QK, 6QR, 6QY, 6TF, 6TO, 6TU, 6UO, 6VX, 6WO, 6WZ, 6AAH, 6AAU, 6ABM, 6ACV, 6ACY, 6AEH, 6AEZ, 6AFN, 6AGF, 6AHP, 6AHU, 6AID, 6AIO, 6AIV, (6KL), 6AKT, 6ALA, 6ALE, 6ALU, 6ANG, (6AOZ), 6APO, 6ARW, 6ASR, 6ATQ, 6ATV, 6AVB, 6AVV, 6AWS, 6BAK, 6BBR, 6BCJ, (6BCP), 6XA, 6XD, 6XG, 6XH, 6XAC, 6XAD, 6XAE, 6XAG, 6XAK, 6ZB, 6ZU, 6ZX, 6ZZ, 6ZAD, 7BJ, 7MF, 7XF, 7YA, 7YJ, 7ZU, 9BEX, 9ZAF.

6GF and 6GR, Sacramento, Cal.

Canadian (9BD), (5ZA), (6AH), (6AR), (6AS), (6AAH), (6AAK), (6AAU), (6AAW), (6ABM), (6ABR), 6ACH, (6ACM), (6ACR), (6ACY), (6ADA), (6ADL), 6AEA, (6AEH), (6AEI), 6AEL, (6AEY), (6AEZ), 6AFO, (6AGF), 6AGI, 6AGK, 6AGR, 6AGP, (6AHP), (6AHU), (6AHV), (6AIB), (6AID), (6AIK), (6AIO), 6AIP, (6AJH), (6AJW), (6AKL), 6AKT, 6ALA, 6ALD, (6ALP), 6ALU, 6ALV, (6AMK), (6AMN), 6ANG, 6ANI, 6ANK, 6ANP, 6ANV, 6ANW, 6APE, (6APH), (6AQT), (6AQU), 6ARE, 6ARK, 6ARP, (6ARW), 6ASO, 6ATB, (6ATQ), (6ATV), 6AUH, 6AUL, 6AVD, 6AVN, 6AVR, 6AVV, 6AVY, (6AWH), 6AWI, 6BA, 6BB, 6BQ, 6BW, (6BAC), 6BAK, (6BDS), (6CH), (6CP), 6CW, (6CZ), (6DA), (6DP), 6DN, 6DY, (6EA), (6EB), 6EF, (6EN), (6ER), (6EX), (6FK), 6FN, (6FT), 6FX, (6GI), (6GP), 6GI, 6GZ, (6HP), (6HY), 6IB, 6ID, 6IK, (6IM), (6IS), (6IVS), 6JI, 6JQ, 6JX, 6JY, (6KA), (6KC), (6KE), 6KK, (6KS), (6KY), 6KX, 6LC, (6LU), (6MH), 6NG, 6OD, (6OC), (6OH), (6OL), (6OM), 6OT, 6PC, 6PI, (6PJ), (6PQ), (6PR), (6QR), (6QS), (6QT), 6QAD, 6RR, (6SK), 6TS, 6TU, 6TV, 6UV, 6VE, 6VJ, 6VM, (6VX), (6WI), 6WO, (6WZ), 6ZE, 6ZR, (6ZU), (6ZZ), 6ZAF, (7BH), 7BJ, (7BK), 7BR, 7CW, (7ED), (7FI), (7GA), 7HF, (7IN), (7IU), 7IY, (7JW), 7KB, 7KD, 7KE, (7KM), 7LY, 7LU, 7LW, (7MF), (7ML), 7MP, 7MU, 7NL, 7OM, (7OZ), 7QN, (7TJ), 7TO, 7YA, (7ZM), 7ZS, (7ZT), 9AYV, 9HM.

C.W.—Canadian 4CB, 5ZA, (6AG), (6EN), (6JE), 6MK, 6OO, 6SC, (6WZ Buzzer), 6AAT, (6ABG fone), (6ALE), (6ANJ fone), (6AOY), (6ARC), 6ASJ, (6AWT), (6AWV), 6BAF, 6XG fone, 6XH C.W., 6XAC, (6XAD), 6XAF, 6ZA, 6ZB, (6ZN), 6ZZ, (7XF), 9AMB, WJK, NCE.

6TV, Tucson, Arizona

2XF, 4MR, 5BM, 5DE, 5FO, 5FI, 5HZ, 5HK, 5IF, 5IR, 5IS, 5KJ, 5KP, 5MK, 5NH, 5NS, 5OH, 5OF, 5QI, 5QQ, 5QA, 5QS, 5XB, 5XU, 5XJ, (5ZA C.W. & Spk.), 5ZAM, 5ZAK, 6AHV, 6AOZ, 6AAH, 6AFW, 6AVR, 6ATF, 6AAU, 6AEZ, 6AAT C.W., 6AWH, 6AFN, 6AVB, (6AMT), 6ADL, 6AEI, 6AAU, 6AID, 6ABP, 6ATQ, 6ACY, 6AQT, 6ALA, 6ANI, 6AIO, 6AKD, (6ASV), 6APH, 6AVD, 6ALU, 6ALE C.W., 6ARW, 6ARC, 6ANT, 6AHP, 6ALA, 6AWH, 6ACM, 6AAB, 6ABX, 6AEZ, 6ADA, 6EH, 6ARY, 6AGF, 6AEF, 6BW, 6CP, 6DA, 6DG, 6EX, 6EF, 6EB, 6FT, 6FK, 6FS, 6GT, 6GR, 6GF, 6GP, 6GI, 6HC, 6IS, 6IC, 6IV, 6JY, 6JI, 6KC, 6KA C.W. & Spk., 6KY, 6KS, 6KM, 6KH, 6LC, 6LU, 6MK, 6MH, 6NB, 6NG, 6OD, 6OC, 6OM, 6OL, 6OV, 6PJ, 6PR, 6PO, 6QR, 6QK, 6SK, 6TU, 6TF, 6VX, 6VZ, 6WZ, 6XG, 6XH, 6XAC, 6XAD, 6XAK, 6ZA,

6ZX, 6ZN Spk. & C.W., 6ZZ Spk. & C.W., 6ZM, 6ZB, 6ZU, 7LU, 7MO, 7ZU, 9AMB C.W., 9AFX, 9AUO, 9AEZ, 9AQE, 9ACN, 9AEY, 9AYW, 9AEG, 9AMN, 9DSD, 9DTM, 9DUG, 9HI, 9NX, 9NR, 9PS, 9ZAC.

6CU, Los Angeles, Cal.

Spark: 5ZA, 6AAH, 6AAU, 6ABW, 6ACM, 6ACR, 6ADA, (6AEH), 6AEV, 6AEW, 6AFN, 6AFS, 6AGF, 6AID, 6AJH, 6AK, 6AKL, 6ALA, (6ALV), 6ANI, 6PE, 6PH, 6AR, 6ARK, 6ARW, 6ASA, 6ASV, 6ATF, 6ATV, 6AVB, 6AVO, 6AVV, 6AWH, 6CP, 6CZ, 6EX, 6FH, 6FK, 6FN, 6GF, 6GR, 6GX, 6HG, (6IC), 6IM, 6IZ, 6JE, 6JI, 6KC, 6KM, 6LU, 6OC, 6OH, 6PG, 6PJ, 6PO, 6PR, (6QR), 6SK, 6TU, 6VK, 6VX, 6WZ, (6ZB), 6ZU, 6ZX, 6ZZ, 7BP, 7HF, 7MF, 7XD, 7YA, 7YJ, 7ZM, 7ZT, 7ZU, 9AYV, 9DM.

C.W.—6AAT, 6ALE, 6AOY, 6ASJ, 6AUL fone, 6AWT, 6JX, 6WV fone, (6XAD), 6XH, 6ZZ, 7XF, 9AMB, 9AZ.

7JF, Moscow, Idaho.

Spark—6AAT, 6CP, 6GR, 6IF, 6IV, 6LY, 6MU, 6QR, 6RA, 6RM, 6VN, 6XA, 6XZ, 6ABX, 6AEZ, 6ARD, 6AWH, 7AF, 7BO, 7EX, (7IN), 7IW, 7JP, 7LR, 7LU, (7LY), (7MF), (7MP), 7XD, 7YA, 7YJ, 7YL, 7YV, (7ZU), (7ZS), 7ZT, 9LP, 9TA, 9WU, 9ACE, 9DOC, 9YR.

C.W.—6ALE, 6XG, 6XAC, 6WV, Canadian (9BO), 5BR.

7LY, Bozeman, Mont.

(4CB Can.), 4AR Can., 5DE, 5HK, 5IF, 5ZU, 5ZJ, 5XD, 6AWH, (6ALE),(6AEZ), 6AAU,(6ATQ), 6AGF, 6ABX, 6CV, 6GD, 6LU, (6OT), (6QR), 6RH, (6SJ), 6WV, 6XG, 6XAC, 6ZM, 6ZR, 6JE, 7AL, 7BZ, 7CO, 7CW, (7EX), 7FI, 7FU, (7GA), 7HM, (7IN), 7IM, (7IW), (7LU), (7MO), (7MP), (7ME), 7MF, (7NL), (7NF), 7TO, 7VK, (7YL), 7YS, (7YA), (7ZU), (7ZE), (7ZK), (7ZS), 7ZJ, 7XF, 7ZR, (7ZM), (7ZO), 7ZP, 9AYN, 9AUO, 9AMB, (9AIF), (9AYW), (9AYV), 9APE, 9AEG, 9AFX, 9AGN, 9ACO, 9AUF, 9FX, 9FS, (9DOC), 9EE, 9HM, 9UU, (9WU), (9YAK), 9YAE, 9ZU, 9ZC, 9ZAF.

7KP, Seattle, Wash.—One Tube

Spark—6AK, 6EE, 6FH, 6FN, 6GF, 6GR, 6IC, 6IV, 6KC, 6LC, 6LU, 6MZ, 6PR, 6QR, 6TU, 6WZ, 6ZU, 6ZX, 6ABX, 6AEW, 6AEZ, 6AFN, 6AGF, 6AID, 6ALV, 6AQT, 6ARK, 6ATQ, 6AWH, 7AW, 7BA, 7BG, 7BH, 7BJ, 7BP, 7BR, 7CW, 7ED, 7FI, 7GJ, 7HF, 7IN, 7JF, 7JW, 7KB, 7KE, 7KS, 7LN, 7LY, 7MF, 7MO, 7MP, 7MU, 7MW, 7NC, 7NL 7NN, 7PV, 7TJ, 7TQ, 7ZG, 7ZJ, 7ZK, 7ZS, 7ZT, 7ZU, 9AIF, 9AMB, Can. 9BD.

C.W.—6EN, 6KA, 6OO, 6WZ, 6ALE, 6AOZ, 6ASJ, 6AWT, 6AWV, 6XAD, 6XAC voice, 6XAF, 7CE, Can. 4CB.

F. H. Stephens, Astoria, Oregon

C.W.—4CB, 6GY, 6KM, 6XAC, 6XAD, 6XAF, 6XG, 7XF.

Spark—5FE, 5ZA, 5ZJ, 6ABW, 6ABX, 6ACD, 6ACM, 6AEZ, 6AGF, 6ALA, 6AR, 6ATQ, 6AV, 6CV, 6EA, 6EX, 6FK, 6IC, 6IS, 6KC, 6NG, 6OC, 6OH, 6OT, 6PJ, 6PR, 6PW, 6QK, 6QR, 6WZ, 6ZB, 6ZX, 7BH, 7BJ, 7BK, 7BP, 7BS, 7EX, 7HF, 7HN, 7IM, 7IN, 7JW, 7KE, 7LD, 7LW, 7LY, 7MF, 7MO, 7MP, 7MW, 7NL, 7NN, 7PO, 7TJ, 7TQ, 7YA, 7YJ, 7ZG, 7ZH, 7ZK, 7ZO, 7ZS, 7ZT, 7ZU, 9AX, 9AYR, 9BD, 9EE.

7ZU, Polytechnic, Montana.

5AW, 5FO, (5HK), 5LA, 5XU, 6AAT, (6ABX), (6AEZ), 6AK, (6ALE), 6ALW, 6AOF, (6APE), (6AS), (6ASK), (6ATQ), 6ATZ, (6AWH), 6AWS, (6CV), (6DN), (6EA), 6EB, 6ED, 6ET, (6GR), (6IC), 6IR, (6IV), 6IY, (6KA), 6LN C.W., 6LZ, (6OC), 6OPJ, (6SJ), 6TEZ, (6WV), (6XAG C.W.), 6XG C.W., 6XJ, 6ZA, 6ZC, 6ZM, 6ZN, 6ZR, (6ZU), (6ZX), (7ED), (7EG), (7EX), 7GO, (7IN), (7IM), 7JD, (7LU), (7LY), 7MO, (7MP), 7NL, 7RN C.W., 7RY, 7TW, 7XF C.W., (7YA), (7YJ), 7YL, 7YS, 7ZJ, (7ZK), (7ZM), (7ZO), (7ZP), 8DJ, 9ABU C.W., 9AEG, (9AEY), 9AIF, (9AIG), 9ALO, 9ALS, 9ALU, (9AMB C.W.), (9AMQ C.W.), 9ANF, (9ANG), 9APN, (9AQE), 9ASN, 9AUO, (9AVE), (9AXU), 9AY, 9AYE, (9AYV), (9AYW), 9DEH, 9DGE, 9DFC, (9DOC), 9DSG, 9DUD, (9DUG), (9DVA C.W.), 9EL, 9ETG, 9EW, 9FU C.W., 9GR, 9HT, (9HM), (9HT), 9IC, 9IG, 9JT, 9LW, 9MIG, 9MS, (9NR), 9NX, 9OHB C.W., 9OI, 9ON, (9PS), 9PU, 9RN C.W., (9RY), (9TI), (9WI), 9WL, (9WU), 9XI, 9XM C.W., 9YA, (9YAE), (9YAK), 9YAL, 9YM, 9YO, 9YR, 9YY, (9ZAC W.), 9ZAF C.W., 9ZC, 9ZH, 9ZJ, (9ZN), 9ZO.

8BUM, Syracuse, N. Y.

Spark—1AMD, 1ARY, 1ASF, 1AW, 1BDC, 1BGF, 1BIS, 1YD, 2ARY, 2BK, 2DA, 2DN, 2DR, 2EL, 2FP, 2OM, 2RM, 2TS, 2UE, 2XK, 3AHF, 3AQR, 3AQV, 3CG, 3PU, 3QN, 3TA, 3US, 3XF, 3XM, 3ZA, 3ZO, 4EA, 4EY, 8ACF, 8ACS, 8AFD, 8AGK, 8AJW, (8AKX), (8AMZ), 8AOV, 8AOT, 8APB, 8AQV, (8AWP), (8AXI), 8BA, 8BBU, 8BIN, 8BOY, (8BRA), 8BRL, 8BSY, 8BTX, 8BUN, 8BXU, 8BXV, (8BZH), 8DZ, 8CG, 8EA, 8EB, 8EW, 8EZ, 8FA, 8FT, 8HY, 8JQ, 8NK, 8OI, 8RQ, 8RU, 8SP, 8XE, 8YM, 8ZB, 8ZY, 9AAP, 9AAW, 9AGG, 9AGR, 9AU, 9AWX, 9DXM, 9MC, 9PD, 9UG, 9YA, 9YM, 9YR, 9ZJ, 9ZN.

C.W.—1AFV, 1AJP, 1ANQ, 1ARY, 1BDI, 1BWK, 1CGG, 1ID, 1PE, 1PT, 1QP, 1RU, 1TS, 1UN, 1XM, 2AAX, 2AFP, 2AJW, 2AKO, 2ARB, 2AYV, 2AWF, 2AWL, 2BAK, 2BEA, 2BEH, 2BFZ, 2BGK, 2BML, 2BRB, 2BSC, 2BUA, 2BZY, 2CCL, 2DA, 2EH, 2FD, 2KL, 2OE, 2RM, 2RU, 2UD, 2VA, 2VH, 2XA, 2XQ, 2ZL, 3AAE, 3AEV, (3AFU), 3AHK, 3ALE, 3ANO, 3ANU, 3AQR, 3BA, 3BAG, 3BIY, 3DH, 3EM, 3FM, 3KY, 3MO, 3PB, 3QV, 3ZA, 3ZY, 4AI, 4BQ, 4BY, 4CD, 4GL, 4XC, 5PG, 5ZA, 8AAZ, 8ABO, 8ADG, (8ADY), 8AEQ, 8AIO, 8AIX, 8AOA, 8AOQ, (8ANQ), 8APT, 8AQB, 8AQR, 8AQZ, 8AVH, 8AWY, 8BA, 8BCI, 8BDU, 8BEF, 8BET, 8BFX, 8BJC, 8BJW, 8BK, 8BNJ, (8BNY), 8BO, 8BOW, (8BOX), 8BPL, (8BRC), 8BRL, (8BSS), 8BSY, (8BUZ), (8BWT), 8CI, 8DE, 8DS, 8DR, 8DX, 8EA, 8EW, 8FB, 8GV, (8IB), 8II, 8IQ, 8IV, 8HA, 8HJ, 8JL, 8KI, 8LU, 8LX, 8OI, 8QU, 8SP, 8TF, 8UJ, 8UK, 8VJ, 8VY, 8WR, 8WY, 8XK, 8XM, 9AAS, 9AAV, 9AJA, 9AKD, 9ALZ, 9AMB, 9ANR, 9ANY, 9ARK, 9ASB, 9AXE, 9BAP, 9BBF, 9BEM, 9DAB, 9DWJ, 9GK, 9GL, (9HD), 9IO, 9KU, 9LQ, 9NX, 9RT, 9TG, 9UU, 9VD, 9VE, 9VJ, 9XAC, 9XAH, 9XI, 9ZB, 9ZV, XF1, NMW, NZO, (WL-2), WUBA, Canadian 3BP, 9AW.

W. L. Bell, Dayton, Ohio

Spark—5BM, 5FU, 5XB, 5XU, 9JN, 9PN, 9PS.

C.W.—1CC, 1RU, 1QP, 1TS, 1XM, 1ARY, 1BCG, 2FD, 2FP, 2WP, 2XA, 2ZL, 2AFP, 2AGL, 2AWL, 2BML, 2BYS, 2CAP, 3CF, 3BQ, 3DH, 3RF, 3QV, 3PB, 3ZZ, 3AQR, 3BAG, 3BIY, 4BY, 4BQ, 4CO, 5ZA, 5XB, 9NX, 9VG, 9YO.

8ASZ, Sandusky, Ohio—One Tube

1ARY, 1AW, 1BDC, 1YDD, 2BK, 2BM, 2DA, 2VW, 2WL, 2BAU, 2CAP, 2OM, 3BH, 3BP Can., 3CC, 3IW, 3QW, 3US, 3XM, 3ACN, 3AQR, 3AQW, 3BFU, 4AS, 4AU, 4BM, (4BQ), 4BY, (4DH), (4EA), 4EY, 4FD, 4FJ, (4GN), 4YA, 5AA, 5DA, 5EK, (5ER), 5FO, (5FV), 5HK, 5JD, 5XA, 5XM, 5ZAB, 5ZL, too many 8's, (9CP), 9GP, 9GX, 9LF, 9LW, 9MC, 9ME, 9MQ, 9IY, 9LQ, 9PC, 9RY, 9TO, 9UG, (9UH), 9UY, 9VZ, 9WI, 9ZJ, 9ZY, 9AAW, 9ACB, 9ACL, (9ACN), 9AEG, 9AFX, (9AGR), 9AIU, 9AIR, (9AJH), (9AMA), (9AOU), (9APS), 9AQE, (9ASJ), (9ASL), 9AWU, 9AWX, (9AWZ), 9AYW, (9AZE), (9AZF), 9BDE, 9BDS, 9DEH, 9DHG, 9DPH, 9DQQ, 9DSD, 9DVE, 9DXT, 9DYU.

8BK, Cleveland, Ohio

Spark—1AW, 1EL, 1II, 2AIM, 2ARD, 2AWF, 2BG, 2BK, 2EL, 2FP, 2GR, 2JU, 2NF, 2UA, 3AC, (3AAO), 3AQR, 3AUY, 3BHL, (3CC), 3DR, 3EZ, 3IW, 3LP, 3OU, 3PU, 3QN, 3RW, 3VW, 3XF, 4BQ, 4CX, 4DH, 4DQ, 4EA, 4EY, 5DA, 5ER, 5EK, 5FV, 5HK, 5RZ, 5RE, 5YQ, 5ZL, (8AFB), (8AWP), (8AFD), (8BQ), (8BAY), (8EB), (8FT), (8NO), (8TJ), (8TK), (8TD), 8WY), (8ZN), (8ZD), 9AF, 9AG, 9AU, 9AW, (9AAW), 9ACN, 9AGE, 9AGG, 9AGR, 9AIJ, 8AIR, 9AMA, 9AMT, 9ANV, 9AOU, 9ASJ, 9AWX, 9AVE, 9AWO, 9AWU, 9AWZ, 9AXU, 9AZA, 9AZE, 9BDE, 9CP, 9DKV, 9DMJ, 9DWK, 9DYU, 9EE, 9FJ, 9FM, 9FS, 9GN, 9GP, 9HM, 9HR, 9JN, 9KO, (9LQ), 9MC, (9ME), 9MH, 9MW,

(9NQ), (9OX), 9ON, 9PD, 9PS, (9UH), (9UU), (9UW), 9VZ, 9WS, 9ZC, 9ZJ, 9ZN, WL-2, NZO, (Can. 3BP).

C.W.—(1AFV), 1AJP, 1AJU, (1ANQ), 1ARD, 1ARY, 1AZD, 1AZU, (1AZW), 1AZX, 1BEA, 1BNN, 1BYX, (1CAK), 1CGG, (1ES), 1JIW, 1PT, (1TS), 1UN, 1WEB, 1XE, 1XX, 2AAX, 2AFP, 2AFU, 2AJF, (2AJW), (2AKO), (2AQI), (2AWL), 2BY, 8BAD, 2BAK, 2BEB, (2BFZ), 2BGH, 2BGM, 2BML, 2BRB, 2BYS, 2DA, (2DN), 2EH, 2EL, (2FD), (2FP), (2FS), (2KL), 2KY, 2OE, 2OM, (2RR), (2RU), 2TJ, 2UD, 2UH, 2WB, 2WP, 2XA, 2XQ, 2YR, 2ZL, 2ZR, 2ZV, 2ZZ, 3AR, (3AAE), 3AEV, 3AFU, 3AHK, 3AJB, 3APA, 3APQ, 3BA, (3BZ), 3BAG, (3BIY), (3CA), (3CC), (3CW), 3DH, (3FM), 3FS, 3GR, 3HG, 3HJ, 3HX, (3MO), 3PB, 3QV, (3RF), 3SQ, 3XA, 3ZL, 3ZN, 3ZO, 3ZY, 3ZZ, (4BQ), 4BY, 4BG, (4EL), (4EN), 4ER, (4FF), (4GL), 4LE, (4XC), 4ZE, 5AF, 5DA, 5LA, 5ZA, (8ADG), (8AFZ), (8AIO), (8AJP), (8AQF), (8AQV), (8AQZ), (8ARO), (8AWP), (8BCI), (8BFX), (8BJV), (8BPL), (8BUM), (8GE), (8HJ), (8II), (8IQ), (8JM), (8JQ), (8KM), (8QY), (8SP), (8TG), (8XM), (8XV), (8ZR), (8ZV), (8ZZ), 9AP, (9AW), (9ABP), 9AAS, 9AAV, 9AJA, 9AJN, 9AKR, 9ARK, 9ARR, 9AVR, 9DAB, 9DKV, (9DWJ), (9FW), (9GL), 9HA, (9HD), 9IT, (9LQ), 9RT, (9RV), (9US), (9VG), (9XAH), 9XI, 9ZB, 9ZV, 9ZY, (XF-1), (NMW), (WL-2), Can. (3BP), 3BA, 3BF.

Breen & Thompson, Minneapolis, Minn.

Spark—5BM, 5EK, 5FO, 5FV, 5HK, 5IF, 5IR, 5IS, 5JD, 5XB, 5XU, 5ZA, 7ZU, 8ACU, 8AFB, 8ARD, 8ASZ, 8AYN, 8GW, 8HO, 8JQ, 8NZ, 8YM, 8YO, 8YU, 8ZG, 8ZP, 8ZY, 9AAP, 9AAW, 9ABV, 9ACB, 9ACL, 9ACN, 9AEG, 9AEY, 9AF, 9AFW, 9AFX, 9AGN, 9AIF, 9AIG, 9AJA, 9AL, 9AMA, 9AMW, 9ANF, 9AOG, 9AOU, 9APN, 9AQE, 9AR, 9ARA, 9ARX, 9ARZ, 9ATN, 9AUO, 9AVE, 9AVN, 9AWU, 9AWX, 9AX, 9AXU, 9AY, 9AYW, 9BFT, 9BPB, 9CP, 9DEH, 9DLX, 9DPB, 9DPV, 9DQQ, 9DSD, 9DUG, 9DZI, 9EE, 9EL, 9FS, 9GL, 9HI, 9HT, 9IY, 9IF, 9JN, 9KO, 9LW, 9MC, 9OA, 9PS, 9SG, 9TI, 9TO, 9UU, 9WI, 9WT, 9WU, 9XM, 9YA, 9YAC, 9YAE, 9YAJ, 9YAK, 9YB, 9YM, 9YO, 9YQ, 9ZAC, 9ZB, 9ZC, 9ZN.

C.W.—3EM, 4BQ, 5YL, 5ZA C.W. & buz., 7IK, 8ACF, 8AFB, 8AJP, 8AKJ, 8AOI, 8APT, 8APW, 8AQF, 8AQZ, 8BA, 8BFK, 8BFX, 8BRL, 8DR, 8IB, 8II, 8JL, 8LF, 8LX, 8RU, 8UJ, 8WL, 8YO, 8XM, 8ZZ, 9AAO, 9AAS, 9AAV, 9AIF, 9AKR, 9AMB, 9ARK, 9ATG, 9AWM, 9BAP, 9BBF, 9BIK, 9DWJ, 9DQZ, 9FM, 9NX, 9RB, 9RT, 9XAB, 9YJ, 9ZJ C.W. & buz., 9ZV, 9ZY, XFI, KDKA fone, WDL.

9DS, Chicago, Ill.—Indoor Aerial

C.W.—1ARY, 1ANQ, 1BIG, 1CAK, 2AAX, 2AKO, 2AWL, 2BAK, 2BB, 2XA, 2XB, 2XQ, 2ZL, 2ZV, 2XD, 3AAE, 3BZ, 3BIY, 3BM, 3BP, 3HX, 3MO, 3PB, 3ZO, 4BQ, 4BY, 4EN, 4BB, 4CD, 4GL, 4XC, 4YA, 5ZA, 6WV, 8ACF, 8AIO, 8AQZ, 8AVH, 8AWP, 8ARK, 8AQV, 8ARW, 8AIX, 8AOG, 8AGZ, 8ALY, 8ACR, 8AOF, 8BDU, 8BEW, 8BOX, 8BRC, 8BUM, 8BXA, 8BFX, 8DR, 8BO, 8DE, 8BK, 8GV, 8II, 8IC, 8JQ, 8JL, 8JS, 8LF, 8KM, 8NQ, 8OZ, 8TN, 8UC, 8UK, 8UJ, 8VY, 8WY, 8XK, 8XM, 8XV, 8ZB, 8ZG, 8ZN, 8ZY, 8ZZ, 9AW, 9ABU, 9AVN, 9VE, 9WH, 9HY, 9AQR, 9DVA, 9HD, 9JD, 9RL, 9AS, 9VG, 9ANR, 9AAS, 9AJP, 9AMB, 9LQ, 9BBF, 9ARK, 9AKR, 9BAP, 9BII, 9DWJ, 9DDW, 9DOF, 9ZY, 9XI, 9XAH, 9ZB, 7ZO spark.

Worked by 9AYV, Boulder, Colo.

(5HK), (5IF), (5JR), (5LO), (5XJ), (5XU), (5ZA), (6AEZ), (6ATQ), (6AWH), (6OT), (6WV), (7DH), (7EX), (7LU), (7LY), (7MP), (7YA), (7ZE), (7ZG), (7ZO), (7ZU), (9AEG), (9AEY), (9AOJ), (9AQE), (9AU), (9AYW), (9HM), (9HT), (9JN), (9LW), (9MC), (9NR), (9NR), (9NX), (9PS), (9VE), (9YA), (9YAE), (9YAK), (9YM), (9ZAC), (9ZAF).

9YAJ, Northfield, Minn.

Spark—5BA, 5BM, 5FK, 5FO, 5HK, 5HO, 5IF, 5JR, 5XB, 5XF, 5XJ, 5XU, 5ZA, 7ZU, 7ZO, 8ASZ, 8AYN, 8DZ, 8EZ, 8HU, 8YN, 8ZAA, 8ZP, 9AAE, 9AAS, 9ABU, 9ABV, 9ACB, 9ACN, 9ACX, 9AEG, 9AEQ, 9AEY, 9AFF, 9AFK, 9AFX, (9AGN), 9AGR, 9AIF, 9AIQ, 9AIR, 9ALO, (9ALU), 9AMA, 9AMK, 9AMS, 9ANC, 9ANF, 9ANG, 9ANO, 9AOU, 9AQE, 9AQM, 9AQR, 9ASJ, (9ASK), (9ASN), 9ATC, 9ATN, 9AUF, 9AUH, (9AUL), 9AUO, 9AVE, (9AUU), 9AWM, 9AWX, (9AWS), 9AWY, 9AYV, (9AXU), (9AYW), 9BDS, 9CP, (9BFT), (9DAG), 9DAO, 9DAR, 9DAY, 9DEH, 9DER, 9DES, 9DGL, (9DGW), 9DJB, 9DJX, 9DKV, 9DOH, 9DOK, (9DOT), 9DPB, 9DQQ, 9DQZ, 9DSD, 9DUG, (9DYZ), 9DZE, (9DZI), 9EE, 9EL, 9ET, 9FF, 9FI, 9FX, 9HI, (9HM), 9HT, 9JG, 9JN, 9KO, 9LF, (9LW), 9MC, 9MS, 9NR, 9OO, 9QC, 9RH, 9RT, 9RY, 9TL, 9TI, 9UU, 9VL, 9PS, 9WU, 9XAH, 9XJ, (9XM), 9YA, (9XI), 9YAE, 9YAK, 9YAL, 9YB, 9YK, 9YM, 9YO, 9ZA, (9ZAC), (9ZC), 9ZH, 9ZJ, 9ZN, (9ZT).

C.W.—1ARY, 1XM, 2AWL, 2FD, 2ZL, 3ZO, 4XA, 5LA, 5XA, 6WV fone, 8AAZ, 8AEG, 8BWJ, 8CI, 8DE, 8DX, 8HM, 8IB, 8II, 8JO, 8LX, 8QZ, 8RU, 8VP, 8WR, 8WY, 8XA, 8XJ, 8XK, 8YN, 8ZG, 9ABU, 9ACG, 9ACO, 9AHN, 9AJA, 9AJP, 9AMB, 9ATN, 9AVN, 9AW, (9AUA), (9BBF), 9DAB, (9DOO), 9DWJ, (9DQM), 9DZQ, 9LQ, 9RV, 9VG, 9WD, 9XAC, 9YAF, 9ZAF fone, 9ZB, 9ZT, 9ZY, XF1, KDKA fone.

9ASN, St. Paul, Minn.

Spark—2OM, 2TS, 3HJ, 4DH, 5EK, 5EW, (5HK), 5JD, 5XB, 5YL, 5ZA, 7EX, 7LU, 7LY, 7YA, 7ZM, 7ZU, 8CI, 8EB, 8FT, 8JQ, 8RU, 8SP, 8VQ, 8YN, 8ZP, 8ACF, (8AFS), 8AQV, 8ARD, 8AYN, 8BBU, 8BRL, (9AU), 9AV, (9CP), 9CS, 9ET, 9FU, 9GP, 9HI, 9JN, 9LF, 9LW, 9NR, (9OA), (9OX), 9PS, 9RY, 9TL, 9TV, 9UH, (9UU), 9WI, 9WT, 9WU, 9YM, 9YO, 9ZJ, 9ZN, 9ABH, 9AEY, 9AFF, (9AFW), 9AGE, 9AGM, (9AGR), 9AIU, (9ALU), (9AMA), 9ANO, 9APN, 9AQE, 9ARU, 9AVE, (9AWZ), 9AXU), 9AYV, 9BDE, 9BFR, (9BKJ), (9DEH), 9DEV, 9DFL, (9DMJ), (9DPH), 9DQQ, (9DSD), (9DXM), 9DZI, 9XAC, (9YAJ), 9ZAC, Can. 3BP.

C.W.—2FP, 2ABI, 3EM, 4GL, 4NX, 5DA, 5ZA, 6WV fone, 8GE, (8II), 8JL, (8LX), 8OH, 8RU, 8SP, 8UJ C.W. & fone, 8VJ, 8VY, 8XK, 8AKE, 8BRL, 8BOX, 9FM, 9RZ, 9WD, 9WX, 9XM C.W. & fone, 9AJA, 9AKR, 9AWM, 9BBF, 9DEV, 9DVA, 9ZAF C.W. & fone, Can. 4CB.

9DNC, Lincoln, Nebr.

Spark—5AL, 5AS, 5BM, 5ER, 5EK, 5EW, 5FO, 5HK, 5IC, 5IR, 5IS, 5JD, 5JR, 5NS, 5OF, 5PD, 5PG, 5QS, 5QY, 5XB, 5XF, 5XJ, 5XU, 5ZA, 5ZL, 5ZS, 5ZAC, 5ZAK, 5ZAT, 7ZG, 7ZO, 7ZU, 8AR, 8CP, 8FI, 8JQ, 8OI, 8YM, 8YN, 8ZL, 8ZY, 8ACF, 8AFB, 8AFK, 8AHY, 8BEP, 8BEW, 9AP, 9AR, 9CP, 9EE, 9ET, 9EW, 9FI, 9GC, 9HI, (9HT), 9IF, 9IY, 9JN, 9JQ, 9KA, 9KF, 9LF, 9LW, 9MC, 9ME, 9HM, 9NH, (9NR), 9OA, 9OI, 9OO 9OM, 9PC, 9DD, 9PI, 9PS, 9RH, 9RT, 9RV, 9RY, 9NQ, 9SU, 9TI, 9TL, 9UG, 9UU, 9VL, (9WI), 9WU, 9WT, 9XI, 9YA, 9YB, 9YD, 9YM, 9YO, 9YP, 9YI, 9ZB, 9ZC, 9ZH, 9ZJ, 9ZU, 9AAW, 9AAP, (9ABV), 9ACB, 9ACL, 9ACN, 9AEG, 9AFW, (9AFX), 9AGN, 9AGR, 9AGW, 9AHZ, 9AIF, (9AIG), 9AIN, (9AIS), (9AEY), 9AIP, 9AIU, 9AJS, 9AKD, (9ALK), 9ALO, 9ALQ, 9AMA, 9ANC, (9ANF), 9ANO, 9ANR, 9ANI, 9AMC, 9AMQ, 9AMS, 9AMZ, 9APK, (9APN), 9AMK, 9AOH, 9AOU, 9AQA, (9AQC), (9AQE), 9AQM, 9ARG, 9ARN, 9ARZ, 9ASJ, 9ASK, 9ASL, (9ASO), 9ASR, (9ATC), 9ATN, 9AUH, (9AUO), 9AVE, 9AWR, 9AWW, 9AWX, 9AXU, 9AYN, 9AYW, 9AZB, 9AZE, 9AZF, 9BED, 9BHD, (9DAC), 9DAZ, (9DBS), 9DBU, 9DEH, 9DEL, (9DFA), 9DFL, 9DFR, 9DFX, 9DGU, (9DHB), 9DHG, 9DIN, (9DIT), 9DJV, 9DJX, 9DKQ, (9DLL), 9DMJ, (9DPB), (9DPG), (9DPW), 9DPH, 9DQQ, 9DRA, 9DUG, (9DUP), 9DSD, 9DSY, 9DVP, 9DWI, 9DYG, (9DYM), 9DZE, 9DZI, 9XAC, 9YAC, 9YAE, 9YAK, 9YAT, 9ZAA, 9ZAC, 9ZAT.

C.W.—5ZA, 6WV, 8DE, 8DR, 8EA, 8XV, 8ZZ, 8ABO, 8BOX, 8AIO, 9LQ, 9NX, 9RM, 9RT, 9VE, 9XM, 9AMB, 9AAS, 9AKR, 9BAP, 9BBF, 9DHB, 9DSM, 9XAE.

Radio Communications by the Amateurs

The Publishers of QST assume no responsibility for statements made herein by correspondents.

Wavelength Range of Tuners.

2637 Garfield St.,
Washington, D. C.

Editor, QST—

The manufacturers of receiving tuners must accept a large part of the blame for our comparatively unsatisfactory results on wave lengths much below 200 meters.

The goodness of an amateur transmitter must of necessity be gauged by the number of amateur stations with which it can communicate. If all other stations have improper tuners the transmitter will appear to be bad through no fault of its own.

It has not been long since we first were offered tuners that would go down to 200 meters, and most of those now offered just manage to get below 200 meters "by the skin of their teeth". Now is it not ridiculous to attempt operating a large number of stations whose sending waves *must* be below 200 and whose receiving tuners start at 170 or 180 and soar up into commercial wave lengths?

Is there not some manufacturer who will produce a tuner that will enable law-abiding operation without placing all stations between 180 and 200 meters? In other words, a tuner whose normal range is from 100 to 200 meters but which can be loaded to 400 so as to reach "Z" and phone broadcast stations. We will then be able to use the short wave length at which C.W. sets can so easily be operated.

Certain stations to our knowledge have done excellent work on waves as low as 150 meters, where QRM at present is so negligible that very low powers sufficed; but despite this excellent showing all these stations have abandoned the short wave and moved up to 200 because no one else could tune down to them. In other words no one within their range had been able to buy a tuner that was made for amateur wave lengths.

Sincerely,
S. Kruse.

We Can QSR Porto Rico Soon.

P.O. Box 868,
San Juan, P. R.

Editor, QST—

I am very glad to answer your letter of Nov. 25 and explain my experiments since May of this year.

My spark set is already complete and is working fine. It has the appearance of a commercial set. I expect to get a good picture and send one to you soon. My C.W. set is being assembled as I am experimenting with different hook-ups. My regenerative receiver is complete, and I am receiving amateurs in the U.S. O.K. I have not picked up 4GL, but 4BC, 4BY, 4LE, 3ZY, 4CF, and 2WG have been heard.

Last night I picked up 1BCG sending to Scotland in the Transatlantic Test. I was surprised. This station came very QSA.

Radio fever is growing between amateurs in Porto Rico and I am making all efforts to start a radio club soon. We have five licensed bugs and about 40 more interested. I am building apparatus for the amateurs in this island, but not on a commercial basis. What I want is to have a real radio club, really representative of the A.R.R.L. in Porto Rico.

I remain,

Very truly yours,
Joaquin Agusty, 4JE.

About Charging for Licenses.

3QJ, Kitchener, Ontario.

Editor, QST—

In the November QST I read with great interest a letter by 8ZF concerning a new license system which he proposes, and I think he has the right idea in the main.

Now, I don't think that it is my place to horn in on something which apparently concerns the United States amateurs only, but at the same time I don't think that there are very many who will endorse his proposal to make a charge of $5.00 for a general amateur license. What Mr. Pancost seems to be driving at is to find some way to stop the activities of what QST terms the "rich amateur", "with a shiny new 1 K.W." If he then proposes to raise the license fee he will be defeating his purpose because who but the "rich" ones can afford such an awful lot of expenditure. $5.00 will buy a new tube and I think that you, Mr. Editor, will agree with me that the amateur with the most money doesn't necessarily have the best DX station on the continent, although money doesn't hamper a good amateur I must admit. You have to have a few good stations if you are going to move tfc. these days. Raising the license fee wouldn't stop 3ZO, for instance, even if they raised it to a hundred dollars.

By the way, has anyone noticed that KDKA gives a strong re-radiation on 150-160 meters? I think that if this trouble is an actual re-radiation and not a freak of our tuner, it should be corrected as the law states that any waves other than the main wave must not exceed 10% of the strength of the main wave, and this re-radiation is about 75 or 80% (at 3QJ). It so happens that Canadian 3GN by some accident got tuned down to 150 meters and I tried to work him one night as he was well under the "Yank barrage" of QRM by reason of his low wave. All went well until KDKA came along and knocked the deuce out of things. KDKA's re-radiation is a little broad while 3GN's wave was quite sharp so we had to QRT for the evening.

Yours truly,
H. S. Gowan.

Graded Licenses.

Walnut Grove, Cal.

Editor, QST—

In the November issue of QST there appears a letter by radio 8ZF, proposing a new license system. He undoubtedly has a fine idea, but I fear he has in some ways gone too far. I believe it would be unjust to make a charge for a license of any kind. We, the people, are forced to buy a license now, as it is, every time we turn our hands to something. Why bring our radio stations in this line, too? Furthermore if it was required that a receiving station have a license, how would the new-comer ever get a chance to learn enough to get this license?

Now here is my scheme, which might be worthy of a little consideration if the opportune time should ever come. When a fellow has sufficent knowledge to obtain an amateur second-grade license, he should be allowed a station of the restricted amateur class, say a wave of 175 meters, an input of 500 watts. At the end of the year, upon passing examination successfully for an amateur first-grade license, he should be allowed a general amateur license, a 200 or 225 meter wave and a full K.W. input. But by no means cut down our already small amount of power.

If a man starts radio with a bang as some do and drops from sight in six or seven months, this fellow will be confined within that first year. Those that see the year through are the boys that love the game, the kind we want with us.

In Mr. Pancost's letter he speaks of a ham starting up on one k.w. and hogging the air until midnight. I venture to say if the present radio laws were enforced they would take ample care of said hams.

In regard to special stations, the law seems just and right now, so why change it?

Even if the present laws were rigidly enforced, fellows, you would see a big change in the old game. Mind the law, have a little respect for the other fellow's rights, and there will be a decidedly different aspect to the future.

Respectfully,
J. V. Wise, 6ZX.

One "Air" for All of Us.

Workman's Institute,
980 Madison Ave.,
Paterson, N. J.

Editor, QST—

We have read with much interest and dismay the communication in your November issue from station 2OM. Mr. Ostman advocates that high powered amateur stations handling traffic have two, or even three operators to work the station so that traffic can be cleared. He also goes on to say that such a system has worked very satisfactorily at his station during the past winter.

Probably Mr. Ostman meant it worked all right for his particular station, for it certainly did not for the many unfortunate stations located within seven or eight miles of him. It is bad enough to have to stand by for a couple of hours until some high powered station gets through, but to sit around all night with hardly a chance to get in even a little local work makes one think lovingly of a wouff-hong or a nice sharp battle-axe.

It is our opinion that a station can handle a reasonable amount of traffic without staying on the air from nine in the morning until five the next, but until some stations realize this all we can do is to hope and pray that some day they will get the "CW" idea and scrap their noisy spark sets.

Yours for a chance at the air,
Radio Club of Paterson, N. J.

More Transcon Reception.

Smith River, Calif.

Editor, QST—

On the night of December tenth I heard a First District amateur station using CW and testing from 8 P.M. to about 9:30 P.M., 120th meridian time. The signals were so astonishingly loud and clear that I could not believe it was a "one" station until the call letters had been clearly heard many times. The call letters were 1BCG, and the following characters were used at various times preceding his signature: PF, TEST, GODLEY, CQ, MGES, and a few "V's". There was spasmodic fading of short duration in which it became barely audible, but on the whole clear copy could be obtained of whatever he said. The wave length was well above 200 meters—about 250 meters I should say.

Evidently receiving conditions over the Rockies were very favorable that night, for while heterodyning 1BCG I heard the peculiar buzz of a CW set using AC on

the plates, rather QRZ, and calling 9ZJ. It proved to be a Second District amateur, 2FS I think.

I assure you that hearing First and Second District stations is a new experience to me, and I certainly got the proper "kick" out of it! Haven't got over it yet, in fact! I am located four miles from the Pacific Ocean and about the same distance south of the Oregon-California line. As I sit at my set of an evening I can sometimes hear the ocean roar. I kind of wonder if 1BCG is also close enuf to the Atlantic to hear it roar!!

In closing, I will state that all receiving was done on a regenerative receiver, with NO AMPLIFCATION whatsoever. No amplification was necessary!

Wishing the QST all the success in the world, I am

Yours sincerely,
H. Romander.

Mounting Honeycombs

Johnstown, N. Y.

Editor, QST—

An old blown 15 or 20 amp. cartridge fuse makes an ideal mounting arrangement for honeycombs. Take your unmounted coil and make a small wood block of the same thickness, and groove it to fit, with a groove in the bottom to fit the fuse, and wind some cambric tape around firmly and shellac. Solder the coil terminals to the brass end pieces of the fuse. Two fuse clips, either in a block or on a panel, provide the mounting. Any degree of coupling may be obtained easily and coils changed quickly. Cheap and efficient.

Chas. E. Gardiner, jr., 8TB.

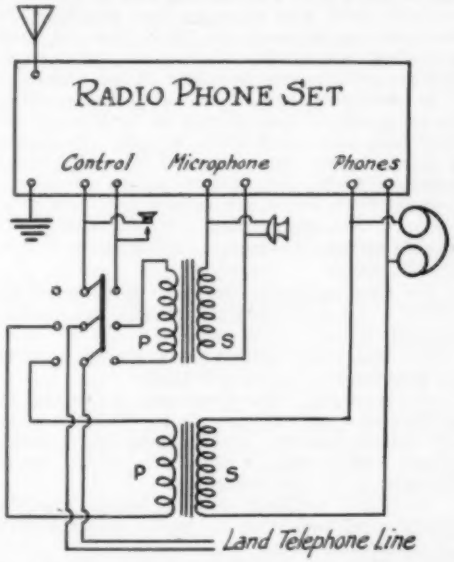
Linking Land and Radio Phone.

P. O. Box 205,
Slayton, Minn.

Editor, QST—

For the last two years I have been scouting around for material on the extension of radio signals to land telephone lines. The only article I have seen on the subject has been too complicated to be of value to the average amateur operator so that I believe it will be of interest to explain a simple device which was designed by the Air Service Research Staff at Langley Field, Va., a few years ago for this purpose. The idea of this equipment is to link the radio phone with land telephone lines and in our purpose it was used for communications between pilots flying in the air and officers on the ground at remote offices reached by the private exchange on the field, etc.

The drawing herewith shows how a radio phone set is connected by transformers to the land line, making use of the regular terminals of a radio phone set to which the control switch, microphone and receivers are commonly attached. The additional equipment consists of a 3-pole double-throw switch and two common telephone induction coils. The secondary of one coil is connected across the modulation transformer of the radio phone, and the secondary of the other coil across the telephone receivers of the radio set, while the two lower switch-arms are utilized to connect the land line to the primary of either



transformer at will. The remaining pole of the switch is used to close the automatic change-over switch when the device is thrown to the talking position.

With this device the radio operator can call a telephone central or answer calls right from his operating table. The radio experimenter can extend his experiments to neighbors not only nearby but anywhere within telephone range, and a great variety of interesting experiments may be performed along this line.

I am sure this will be of interest to QST readers and would like to hear from any who try it.

Yours truly,
K. B. Dokas, 9DKL.

Good Ideas on Electrolytic Rectifier Operation.

Box 532,
Bradentown, Fla.

Editor, QST—

I have read with great interest for the last year your valuable little magazine, and while I am not at present in the game with a transmitter, still possibly I might be called one of the "boys" due to the fact that I was at one time operator at the old DeForest station on Barge 94, also serving as assistant at old GV at the city

of Galveston, Texas, from which I have recently moved to this little town. This radio experience dated way back to the days of the Morse code and untuned sets with the Fessenden electrolytic detector—those were the happy days!

Now I have noticed several times that considerable interest is being taken in the electrolytic rectifier, for charging batteries and high tension D.C. for plates of tubes in C.W. sets, and thought that possibly the writer's experience in this line of construction might be of a little interest to those needing and building these valves.

In the first place, the electrolytic rectifier is as good as the tungar if properly constructed and used with proper chemicals. I don't know who started the old borax solution idea, but forget it, as there are several that are much better and nearly as cheap. Folowing these simple rules will enable anyone to secure satisfactory results in *all cases.*

1. Use nothing but PURE ALUMINUM. An alloy positively will not rectify enough to call it a rectifier.
2. Use nothing but pure water, secured at any battery service station.
3. Arrange the electrodes as close together as you can get them, using a piece of rubber at top and bottom to separate them, with a rubber band around the group to hold rigid in container.
4. Use nothing but a brass machine screw and lock nut to make contact with the aluminum, and keep clean.
5. The non-rectifying element may be iron, carbon, lead or anything that is not acted upon to any extent by the type of solution used, lead being generally used.
6. Secure some syrup PHOSPHORIC ACID (pure) and pour in pure water, 3 oz. acid to pint water, then add best grade ammonia until solution tests neutral with litmus paper. Then wait until cool and add enough ammonia to turn the paper blue, which result is slightly alkaline.

If impossible to obtain phosphoric acid, use boracic acid until solution is saturated, then add ammonia as before. Other solutions that can be used are sodium phosphate and sodium orthophosphate, and carbonate of soda, all being saturated solutions in pure water.

This is by no means the limit of solutions you can use but the ones that the writer has had experience with.

Contrary to general ideas, these solutions will not require that the plates be formed, and can be used as soon as fully mixed and cooled. These rectifiers always work best with a cool solution and for that reason more attention should be paid to the size of the container than to the size of the plates or electrodes. For example, a plate of lead and one of aluminum 4 by 6 inches will carry 5 amps. as long as needed if the solution is of sufficient quality to keep cool, and should not get more than luke warm.

It is very important that you do not get your plates too large, as there is always some leakage, and higher efficiency is obtained by working the plate to the very limit thus securing a more heavy coat of oxide. But this can *only* be done with the solution kept cool.

For the small amount of current required in tube radiophone work, I can see no reason for larger than one square inch of surface on each plate of each cell. If you are using a two-element cell, always make the lead plate in the form of a U with the aluminum in the center, thus securing a better current distribution.

To test the rectifier solution, use both plates of aluminum and connect to A.C. mains, and if solution is good you will see a haze of light all over the surface of the aluminum plate with not enough current flowing to move your meter disk. If there is any doubt about solution insert a small resistance in series with cell. If your solution will not haze, you have used it long enough so use some fresh. As a suggestion, I have secured fine cooling by setting the jars in a pan of water, which radiates the heat as fast as generated.

With best wishes,
Geo. Roy Clough.

Spark Coil DX.

Seattle, Wash.

Editor, QST—

A couple of months ago you published what was said to be a record for a spark coil, covering about thirty miles. Last summer Ralph Willison, now 7BP, and I did some work which exceeded that. We started experimenting with coils between the Port Moller and Nelson Lagoon stations of the Pacific American Fisheries Company, in Alaska, located about thirty miles apart. Then when his generator burned out, for two months we handled all our business, averaging around 200 words a day, on the coils. He used an ordinary Connecticut ignition coil and I had a coil that made a spark about 1/16 of an inch long when connected direct to the aerial. Used six volt batteries most of the time. We maintained five schedules a day without the slighest difficulty, using a single bulb for reception most of the time. With the same coil I worked Libbyville, Alaska, over 200 miles distant a number of times in daylight, and for three months maintained a regular schedule with another station at Unga, forty-five miles overland. I think this amounts almost to a record.

Trusting it will be of interest, I remain,
Very truly yours,
Leroy Manor,
ExKWR, Port Moller, Als.

A Good Word From Mr. Hays

Office of the Postmaster-General,
Washington, D. C.
Nov. 29, 1921.

The American Radio Relay League, Inc.,
Hartford, Conn.
Gentlemen:

My attention has been called to an editorial in your November, 1921, number of the QST. It is evident that you are laboring under a wrong impression concerning the attitude of the Post Office Department regarding radio communication.

While no rearrangement of the communication activities of the Government has been made, I take this opportunity to advise you that in case the Post Office Department takes an active part in radio communication, my policy will be to aid the amateur in every way possible.

That this is already a fact is proven by our present activities. We are now broadcasting government information from eight of the Air Mail radio stations situated at various points between New York and San Francisco, and it is the intention of this Department to amplify this broadcasting system to cover all parts of the United States, both by radio telephony and radio telegraphy. Naturally, we will depend upon the amateur for the receipt and dissemination of this information.

This being the case, I am inclined to believe that our activities demand the closest co-operation with the radio amateurs of the United States.

With best wishes,
Very sincerely,
(Signed) Will H. Hays.

Messages Must Be Delivered.

2nd Field Artillery Brigade Hdqrs.,
Camp Travis, Texas.

Editor, QST—

I would like very much to bring to light an important subject on which little has been said in the past, and that is the delivery of messages. It seems very deplorable indeed that certain stations will accept msgs. and not QSR them to the next station or forward to their ultimate destination. I have had the opportunity to investigate this situation to a certain extent and find the following. These reports pertain to long distance messages and are from stations in and around San Antonio, including my own.

About half of the messages sent are really delivered in a reasonable length of time. One-fourth never reach their destination at all and the other fourth take between two to four weeks to get there. I know of many cases where the sender of a radio msg. has several weeks later written to the particular person to whom he had sent a msg. and found that it either had not been received or that it had been received long after it started out from the sender.

Now there is no reasonable excuse for this delay of msgs. and if a station accepts one he should QSR at once or as soon as possible in order to keep it going. There is positively no use in sending messages by radio if they are to take so long in reaching their destination. A person might just as well use the mails and in fact might better do so if he wants quick service. It appears that most every amateur nowadays has the long distance craze, and consequently would sooner delay a msg. a few days in order that he might give it to some faraway DX stn. than QSR to a nearby station even 100 miles distant, and keep it going. If the big commercial stations that handle public correspondence did this, we would have *some service.* Hi!

So, DX men, if you accept a msg. for the love of Pete PUSH IT ON. Don't leave it on your files for several days, weeks or months. If you can't QSR, don't accept them.

Yours for better service,
Staff Sgt. R. C. Walkeen,
Radio 5ZAK.

Electrolytic Rectifiers.

1025 Baldwin Ave.,
Ann Arbor, Mich.

Editor, QST—

In regard to the letter of C. C. Pidgeon about electrolytic rectifiers, in the November QST, I have one more point to add to his side of the question.

He mentions the "additional cells" when only one secondary is used, but there need be no additional cells. Assuming, as he does in Figure 2, that each cell will withstand 200 volts, there should be twelve cells in Figure 1, six cells in each series, for it is evident that each series must be able to stand the voltage of both secondaries, in this case 1200 volts; because when one series acts as a non-conductor, the other series is a conductor. So it will be seen that the same number of cells is needed for each system.

73, OM, CUL.

David R. Inglis, 8AGF.

Re Intermediate Signals.

Toronto, Ontario.

Dear Ed—

Say O.M., some months ago, in order to be able to distinguish between the Canadian and American amateurs, it was agreed that all Canadian amateurs working Canadians should use intermediate signal ...— (v). Art., but since when have the following been Canuck hams: NSF, WII, WSO, NNZ, NSM, NSS, and a whole raft of others? I looked them all up in the call-

book and they seem to be American commercials. Funny. (Whispers of "Le's tell T.O.M.") Hw abt it? Since when the change from —.. . (de)? If tt aint against The Radiotelegraphic Convention rules I will eat my squeak box, and make the spark gap.

Best 73's to the gang.

Oliver Rosebank.

Replies to "A Novice"

Dear Mr. A Novice:—

I take great pleasure in assuming the title "The Dub Next Door," created in your recent letter in QST.

If you still have a desire to hear POZ and have no prejudice against using an aerial to accomplish this end I suggest that you try once more using both an aerial and ground. With these superfluous connections I have copied POZ, LCM and IDO at various times when Marion had the grace to stop screaming, (I mean WSO of course,) without finding it necessary to make the much talked of resonant click materialize at all.

The results which I have obtained on 200 meters are most satisfactory and compare favorably with those obtained on a Grebe CR2.

I have found that the combinations of coils suggested by Mr. Groves to be correct in nearly every case but I will say that it takes time and experience to acquire an intelligent knowledge of tuning and disappointment is bound to follow at first.

The tapes around my coils had a decided affinity for water but being more ingenious than to lay them away I removed the tapes and baked them in an oven, shellacing while warm. This entirely eliminated their tendency to collect moisture.

Hoping this will renew your curiosity for hearing POZ, I would appreciate your QRA OM.

Sincerely yours,

L. S. Bellem, 1HBS.

Ground Leads

636 Broad Street,
Central Falls, R. I.

Editor, QST—

Re the inquiry of Mr. F. B. Hanes in the June number of QST I would like to relate the experience in my case. My transmitter is not on the fourth floor, but is on the SECOND and 18 feet above the ground. I have two separate ground leads: the first 8 feet long goes to the water and radiator system, the second 22 feet long goes directly to a buried plate beneath the window. On the same setting of the O.T. secondary my wave length is 205 meters with the first ground lead and 225 meters with the second, each one used separately. I had to insert a series condenser in this second lead to bring down the wave to the proper value. I believe that the large mass of metal that constitutes the radiator system lowers the wave length something the same as when a counterpoise is used.

Hoping this will help a little, I am,

Sincerely yours,

Philip McManus, 1AIT.

Doubleday-Hill Federal Head Set
2200 ohm ... $8.00
3200 ohm ... 10.50

Send Us Your Orders for

Radio Equipment

Highest Quality—Lowest Prices—Prompt Service

Distributors for Grebe, DeForest, Chelsea, Radio Corporation of America, Murdock, Signal, Magnavox and other highest grade Radio Apparatus. All sizes of Radiotron Vacuum tubes always in stock.

Get the new Grebe Regenerative Receiver CR-9—the ideal equipment for C-W and radiophone reception. 150-3,000 meter wave length—all the latest Grebe features including moulded variometers, rubber-tired verniers, etc. The final word in simplicity of operation.

Send for "Radio Corporation of America CW Booklet". Mailed postpaid for 25c

Mail orders promptly filled. Dealers,—Write for discount.

DOUBLEDAY-HILL ELECTRIC CO.

715 12th St., N. W., Washington, D. C., Radio Dept.—Desk A. 719-21 Liberty Ave., Pittsburgh, Pa.

SAY, FELLOWS,

The Third Annual Convention Of the Third and Fourth Radio Districts

is going to be SOME convention.

Everybody is whooping it up—letters are piling in for ticket reservations.

Indications are that they will all be bought long before the convention—SO

Get Your Tickets Early

THE LADIES ARE MOST CORDIALLY INVITED!
And Remember—

Five dollar ticket entitles you to all:

Snappy technical sessions—Unusual Exhibits
NAA and NSF Tours—THE BANQUET.

Don't forget the date:

February 17 and 18, 1922

Raleigh Hotel, Washington, D. C.

Make your reservations early—
Apply to E. R. Bateman, Publicity Manager,
1217 W. Lafayette Ave., Baltimore, Md.

FOURTH DISTRICT REPRESENTATIVE

B. W. Benning, 50 Whiteford Ave., Atlanta, Ga.

It is requested that delegations report their expected hour of arrival in Washington to H. L. Strang, 2020 1st St., N. W., Washington, D. C., Chairman of Welcome Committee.

LOOK FOR WELCOME COMMITTEE AT UNION STATION. THEY WILL WEAR WHITE BADGES WITH A. R. R. L. EMBLEM.

A RECORD BREAKER

TYPE JM RADIO-AUDIO FREQUENCY AMPLIFIERS
$95.00

Music from Radiophone station 200 miles away, heard 3 feet from fones by using "plug in" **DX RADIO FREQUENCY AMPLIFYING TRANSFORMERS** and **18 inch** portable coil aerial.

DX Radio Frequency Amplifying Transformer

Wavelength Range	Price
170-650	Each $8.00
650-2000	Each 8.00
2000-5000	Each 9.00
5000-12000	Each 9.00
Transformer	Mounting $1

Buy an Amplifier complete or build your own. We supply parts and circuit diagram.

Dealers being supplied

Amplifier circuit diagrams.....**25c**

Send stamp for Bulletin No. 11.

Radio Instrument Co.

Hutchins Bldg., 10th and D, N. W., Washington, D. C.

BURGESS "B" BATTERIES

(Individual cells completely insulated)

The Standard of Quality

Ask the operator who uses them

5156 (with taps) *Send for Bulletin No. 18 for prices and complete descriptions*

BURGESS BATTERY COMPANY

HARRIS TRUST BLDG., CHICAGO

MURDOCK

radio necessities

No. 56

MURDOCK REAL RADIO RECEIVERS have delivered complete satisfaction, on a "money-back" basis for 14 years. Those years of experience have so simplified and perfected our production that there are today no receivers quite so good at so low a price.

The latest Murdock achievement, the No. 56 Receiver, is a highly sensitive instrument which retains all the rugged strength of previous types. Important features are, the improved comfortable headband, the "Murdock-Moulded" ear pieces shaped to exclude outside noise, and the riveting of all parts into one durable unit.

All models of Murdock receivers are sold with free trial offer and money-back guarantee. Use them in direct comparison to any other phones for 14 days. Make any test you wish. Then at the end of the two weeks, if the Murdock Phones are not entirely satisfactory, return them and your money will be refunded!

We strongly urge you to go to your dealer, and convince yourself of the quality of Murdock receivers, by actual examination, before you buy. **Prices $4.50 to $6.00.**

Murdock Phones are the standard bearer for a complete line of "Made-by-Murdock" radio parts and instruments. This includes the famous Murdock condensers, couplers and variometers, and the new Murdock Rheostat at $1.00.
Send for Free catalogue.

WILLIAM J. MURDOCK CO.

65 CARTER ST., CHELSEA, MASS.

Pacific Coast Office, 509 Mission Street, San Francisco, Cal.
New York Sales Office, 1270 Broadway, New York.

BUILT WITH BLUE PRINTS

65 Sawyer Avenue,
Dorchester, Mass.
Nov. 15, 1921.

Experimenters Information Service
45 Pinehurst Ave., New York.

Gentlemen:—

Such decidedly satisfactory results were obtained with the 160 to 1000 meter Regenerative Receiver built with your BLUE PRINTS 30021, 22, 23, 24 that I am giving a few details.

On 600 meters it is not unusual to pick up ships 1000 to 2000 miles east and south of here communicating with VCE, NGE, NAM and other coastal stations.

On short waves the results are remarkable being able to copy 4th and 5th district stations nearly every evening using just a detector. With careful manipulation the selectivity and signal strength exceeds that obtained in any of six other types I have tried.

By building instead of buying I have saved over $50.00 on this one instrument and heartily recommend your plan.

Yours respectfully,

(Signed) Norman A. Nyquist.

The above BLUE PRINTS include the very latest commercial research on short wave reception, the complete details both electrical and mechanical are shown on four blue prints 21 by 28 inches, price $4.00.

The BLUE PRINTS covering 22 other subjects including CW Sets and Radiophones include new commercial research data which has not been published in any magazine to date.

INSPECT THE BLUE PRINTS AT YOUR DEALER OR WRITE FOR BULLETIN H

EXPERIMENTERS INFORMATION SERVICE
45 Pinehurst Ave., New York City

What Radio Companies Want

In times like these when jobs are scarce, the companies hiring radio operators look for men who are more than just license holders. They want men thoroughly familiar with the latest types of ship sets, the handling of commercial traffic, compiling of abstracts, as well as the care and repair of radio installations.
Our course has been thoroughly revised by a committee including the chief operators of two of the leading radio companies on the East coast. Classes just starting in the following:

ARC—SPARK—VACUUM TUBE
ABSTRACTING—REPAIRING
OPERATING
SEND FOR BOOKLET 150

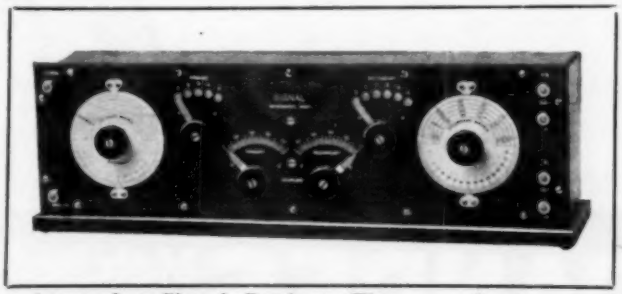
Y.M.C.A. RADIO SCHOOL
150 East 86th St., New York
"The Best Radio School in the East"

SIGNAL

Latest Products of the "Signal" Laboratory Told in the New Signal Literature!

Whether like the novice, you look upon the Art of Radio as a great **"game,"** or like the experimenter, it is to you the great **Business**—in either case, you want to keep abreast of developments in apparatus and equipment.

SIGNAL LABORATORIES continue to bring forth more modern and efficient radio equipment, yet there is no let-up in the demand for earlier popular SIGNAL instruments such as have helped make wireless history.



A popular Signal Product—The new short wave Tuner, R-37-C. Described in the new Bulletin.

Therefore, the new SIGNAL Bulletin covers the whole field of Signal Wireless Products—and it is free to you if you use the attached coupon or a postcard.

TEAR OUT AND MAIL THIS COUPON NOW!

SIGNAL ELECTRIC MFG. CO.,

MENOMINEE, MICHIGAN

COUPON

Send me the new Signal Wireless Bulletin W

Name .....

Company .....

City .....

State .....

QST

A Good Way to Spend Your Xmas Check

Invest it in a Brandes Headset; something out of which you can get daily pleasure for years to come.

Brandes Headsets are scientifically designed; constructed by experts; mechanically perfect in every detail.

In professional, scientific and amateur use all over the world. Proving satisfactory under all conditions.

"Navy" type headset	**$14.00**
"Superior" type headset	**$8.00**

Sold on 10 days' trial. Money refunded if not satisfactory.

Send 5c for catalog F.

DEALERS, Write for our proposition.

C. BRANDES, Inc.

Room 821, 32 Union Square, New York City

BRANDES Matched-Tone HEADSETS

ANNOUNCEMENT

The New DEFOREST CATALOGUE

is now ready and includes cabinet receiving sets, panel sets, C.W. transmitters, radiophones and parts, for amateur use. Sent upon request and receipt of 12c in stamps.

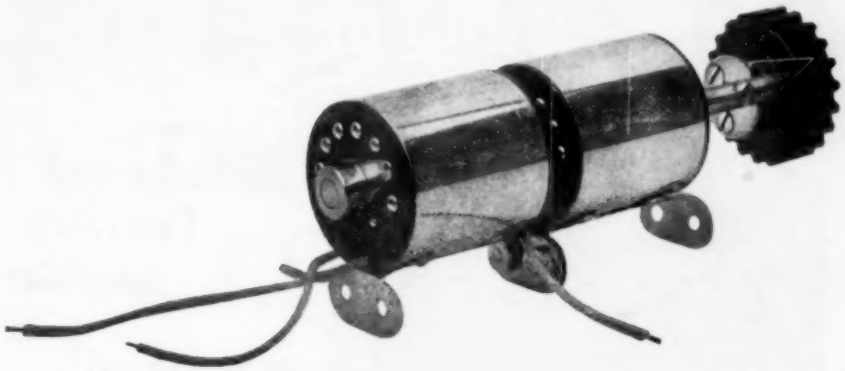
ANNOUNCEMENT

The New DEFOREST RECEIVING SETS

will be described and illustrated in this magazine next month. Do not buy until you see February Issue.

DeForest Radio Tel. & Tel. Co.
New York City

Radio Frequency Amplifier



Pat. Appld. For

There is nothing that opens up a wider field on the receiving end for the amateur and experimenter, than radio frequency amplification.

After an extensive investigation of the various types of tube couplings possible for radio frequency amplification, we have developed the above units (two are shown) with a view to giving maximum efficiency and greatest ease of control, at a reasonable price.

Tuning each stage is not necessary. Only one adjustment necessary to cover fairly wide bands of wave-lengths with several stages.

Transformers for several stages can be mounted in tandem with single control which greatly simplifies the manipulation of the set.

Remember that radio frequency amplification will increase the range, the selectivity and the satisfaction you can get from your receiver. A loop antenna will be far more effective with radio frequency amplification.

These units will cover wave-lengths from 180 to 750 meters.

TYPE 5000 RADIO FREQUENCY AMPLIFYING TRANSFORMERS, $5.50

COTO-COIL CO.

87 WILLARD AVE.,
PROVIDENCE, R. I.

THE FOLLOWING DEALERS CARRY OUR APPARATUS—CALL IN AND SEE THEM

SOMERVILLE RADIO LABORATORY
Somerville, Mass.
WHITEHALL ELECTRIC CO.
Waterbury, Conn.
R. I. ELECTRICAL EQUIPMENT CO.
Providence, R. I.
DELANCEY FELCH & CO.
Pawtucket, R. I.
CONTINENTAL RADIO AND ELECTRIC CO.
New York, N. Y.
THE SAUTER CO.,
Schenectady, N. Y.
THE CRAMER HARDWARE CO.,
North Tonawanda, N. Y.
HUGHES ELECTRIC CORP.,
Syracuse, N. Y.
STERLING HARDWARE & ELECTRIC CO.,
Jamestown, N. Y.
RUSSELL MFG. CO.,
Niagara Falls, N. Y.
RADIO SUPPLY SERVICE,
Mount Vernon, N. Y.
JATH WIRELESS CO.,
Buffalo, N. Y.
RADIO ELECTRIC CO.,
Pittsburgh, Pa.
LANCASTER ELEC. SUPPLY & CON. CO.,
Lancaster, Pa.
R. SELWAY COLLMUS,
Baltimore, Md.
JONES ELECT. & RADIO MFG. CO.,
Baltimore, Md.
WHITE & BOYER CO.,
Washington, D. C.
CARTER ELECTRIC CO.,
Atlanta, Ga.
HERBRICK & LAWRENCE,
Nashville, Tenn.
SMITH NOVOTOY ELEC. CO.,
Charlotte, N. C.
NOLA RADIO CO.,
New Orleans, La.
JULIUS ANDRAE & SONS CO.,
Milwaukee, Wis.
INDUSTRIAL RADIO SERVICE,
Saginaw, Mich.
DETROIT ELECTRIC CO.,
Detroit, Mich.
WM. HALL ELECTRIC CO.,
Dayton, Ohio
SALZER ELECTRIC CO.,
Cleveland, Ohio.
WIRELESS MFG. CO.,
Canton, Ohio.
MARSHALL-GERKEN CO.,
Toledo, Ohio.
PRECISION EQUIPMENT CO.,
Cincinnati, Ohio
RADIOLECTRIC SHOP CO.,
Cleveland, Ohio.
SCIENTIFIC ENGINEERING CO.,
Cincinnati, Ohio
DODGE'S RADIO INSTITUTE,
Valparaiso, Ind.
TELEPHONE MAINTENANCE CO.,
Chicago, Ill.
WESTERN RADIO CO.,
Kansas City, Mo.
WESTERN RADIO ELECTRIC CO.,
Los Angeles, Cal.
ALTADENA RADIO LABORATORY,
Altadena, Cal.
SCIENTIFIC EXPERIMENTER, LTD.,
Montreal, Canada.

Standard

Dectector and Two-Step Amplifier

unwired!

Commercial type, $55.00

Amateur type, $47.00

Wire Your Own - Save $10.00

THE Standard Assembling Company has done all the panel drilling, mounting etc., which is essentially machine work, with the proper machine equipment. The wiring is left for you to do. In this way you get the superior appearance and performance of high-grade machine assembled apparatus at a clear saving of $10.00. For either type, fully wired, is offered for exactly $10 more. The commercial type incorporates UV712 transformers and General Radio Sockets.

The amateur type is an exact duplicate, except that transformers and sockets of high efficiency but lower cost are used.

Either type shipped anywhere in the U. S. on receipt of one-third the purchase price. Examine the instrument carefully, and either remit the balance, or return the instrument for refund. Could we make a fairer offer? Then take this opportunity to try the "Standard" plan at our risk!

Or, send stamp for literature describing the entire line.

Standard Assembling Company

19 BRIDGE ST., Dept. Q-1. NEW YORK

$5.00—C W INDUCTANCE—$5.00

20 TURNS—7¼" Dia. HARD DRAWN COPPER WIRE, BAKELITE INSULATION

A first class inductance for that new C-W set. Why try to get along with a makeshift coil when you can purchase a reliable inductance for this price? Price on additional turns on application.

$2.00—GRID COILS—$2.00

C W TRANSFORMERS

100 Watt, $8.00 150 Watt, $9.50 250 Watt, $11.00

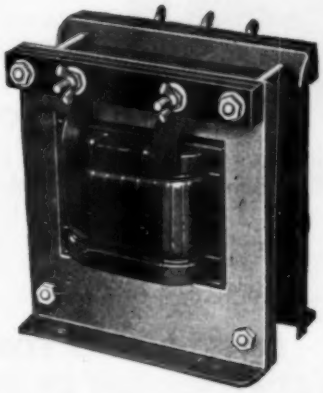
Primary—110 Volts—60 Cycle—Filament Winding over primary—8 Volts —Center Tap. Wound on insulating tube.

SECONDARY wound for—350 Volts—425 Volts—500 Volts with Center Tap. Wound on insulating tube.

Iron core cut to length but not assembled. All taps marked—coils tested Instructions for assembling furnished. Prices on other sizes on application ¼" thick Aluminum 4x5 inches 30 cents per piece. All articles subject to return within 10 days if not found satisfactory on inspection. Goods securely packed, and shipped C. O. D. unless remittance accompanies order.

M. B. TERRELL, 22 E-9th Street, Holland, Mich.

SHELL TYPE
Transformers
FOR C.W.



The Superiority of Shell Type Transformers Is Recognized

FOR FILAMENT HEATING

Capacity Watts	Sec. Volts	Price Unmounted	Mounted
80	8.5	$6.00	$7.00
150	12	8.00	10.00
300	12	12.50	15.00

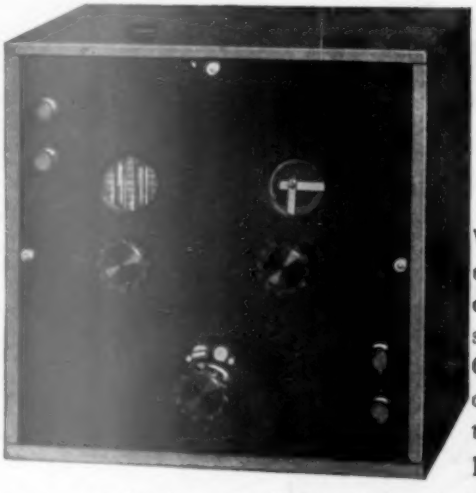
FOR PLATE SUPPLY

Capacity Watts	Secondary Each Side of Neutral	Price Unmounted	Mounted
100	350 and 550	$11.00	$13.00
450	1000 " 1500	16.00	18.00
900	1000 " 1500	27.00	30.00

WE MANUFACTURE TRANSFORMERS DESIGNED FOR ONE 5 WATT TUBE, WITH SECONDARY VOLTAGES OF 10 AND 650, BUILT SHELL TYPE, UNMOUNTED ONLY, PRICE $7.50.

Thordarson Electric Mfg. Co.

517 S. Jefferson Street. **Chicago**



The First Time In The History of Citizen Radio.

A Relay and Recorder Avaialable to the Amateur.

THE HALL RELAY

Will record all radio signals on tape, operate a sounder, buzzer, bell, or other electrical device, from the radio signal as ordinarily received by ear. Operates directly off of a standard receiver, and opens and closes a circuit through sturdy contacts.

PRICE COMPLETE $125.00

Our new catalog is ready, illustrates hundreds of standard parts for wireless apparatus as well as many radio telegraph and telephone receivers and transmitters. Many pages of instructions and diagrams. It is the most comprehensive and Deluxe edition of a radio catalog, ever offered the experimenter. Send 15c in stamps for it, and they will be credited on your first order for $2.00 or more.

Our stocks are complete and we are prepared to give you prompt deliveries on the following lines.

DISTRIBUTORS FOR

RADIO CORPORATION OF AMERICA
WM. J. MURDOCK CO. **CHELSEA RADIO CO.**
DEFOREST RADIO TEL. & TEL. CO.
A. H. GREBE & CO. **CLAPP-EASTHAM CO.**
WESTINGHOUSE RECEIVERS
JOHN FIRTH & CO. **BALDWIN RECEIVERS**
AMRAD PRODUCTS

SOLE MANUFACTURERS AND DISTRIBUTORS IN THE WORLD OF HALL RELAYS AND TAPE RECORDERS
Patented in all countries of the world

The KARLOWA RADIO CO.

ROCK ISLAND, **ILLINOIS**

QST QST QST de 8ZY 8ZY 8ZY

We are representatives of 42 leading radio manufacturers a few of which are Paragon, Z-Nith, Grebe, Telmaco, Chi-Rad, Ray-Di-Co, Firth, Baldwin, Murdock, Brandes, Tuska, Parkin, Magnavox, Burgess, Radio Corp, All-American, France, Jewell, General Radio, Benwood, Atlas, Acme, Thordarson, etc. We would like to serve you—May we have your orders?

We are also bringing out a line of SUPER-RADIO products to be announced each month in QST. Our Super-Synchronous gap is the first. **THE PEER OF 'EM ALL. PRICE $68.50.** (10% Discount during January) Send for circular and cut.

THE TRI-STATE RADIO MFG. AND SUPPLY CO.

1000 WILHELM STREET
8ZY **DEFIANCE, OHIO.** **8ZY**

INTRODUCING

Are-Dee-Cee

Radio Equipment

The RADIO DEVELOPMENT CORPORATION, of Springfield, Mass., which has been conducting an exclusive Radio Shop for the last three months, supplying the needs of Amateurs and DX Operators in Western New England, has recently acquired a Laboratory and Manufacturing department for the construction of

RECEIVING and C.W. EQUIPMENT

filling a long felt demand for high-grade, well built sets, at prices within reach of everyone's purse. All such apparatus will be marketed under the

ARE-DEE-CEE
Trade Mark

We guarantee any article bearing that Trade Mark to be perfect in workmanship and of the finest material obtainable. No instrument leaves our factory before undergoing a thorough test and careful inspection.

The first members of the ARE-DEE-CEE family are

A complete Receiving Set

Consisting of an especially designed Tuner, Detector and 2 Stage Amplifier, in a beautiful Cabinet. Wave length range 150-600 meters, (can be loaded to 20000 meters.)

$85.00 complete.

A Special C.W. Inductance

Built of the finest material, 6" high, 4¼" diameter, 40 turns of finest grade copper wire, #12 B & S gauge.

$5.00 complete.

We are also prepared to build any parts or complete outfits on special requirements or designs. As in our regular equipment, only the finest material will be utilized and skilled workmanship guaranteed.

PERMIT US TO SUBMIT ESTIMATES ON YOUR REQUIREMENTS!

RADIO DEVELOPMENT, an interesting, illustrated paper on Progress in Wireless Telegraphy and Telephony sent FREE for 3 months. Just mention QST.

RADIO DEVELOPMENT CORPORATION

97 DWIGHT STREET, SPRINGFIELD, MASS.

A DEPENDABLE RADIO TELEPHONE—IT WORKS!

FELIX & DIEHL'S RADIO COURSE CWC—$10

RADIO CORP. C.W. INDUCTANCE $11.00 OR WIMCO C.W. INDUCTANCE, 25 TURNS, $10.00

50 WATT TUBE R.C. GRID LEAK $1.65. 5 WATT TUBE R.C. GRID LEAK $1.10.

PACENT 2580 SERIES CONDENSER 5000V. $4.50

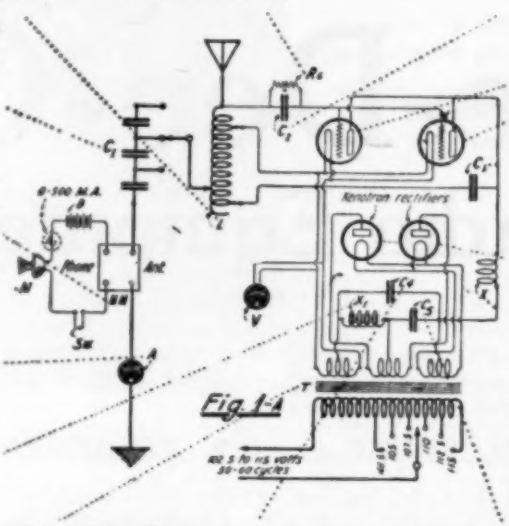
MAGNETIC MODULATOR
UT 1643, $9.50
(½-1½ AMP. CAP.)
UT 1357, $12.50
(1½-3 1-3 AMP. CAP.)
UT 1367, $17.00
(3½-5 AMP. CAP.)

G.R. HOT WIRE AMMETER, $7.75.
0-½, 0-1, 0-2½, 0-5, 0-10, SCALE READINGS.

TYPE JT THERMO-AMMETER $12.00

0-1½, 0-3, 0-5, & 0-10 AMP. RANGES.

FEDERAL 800 M.A. CHOKE COIL $7.50



SOMERVILLE C.W. CONDENSER, 75c. OR R.C. UC 1014 CONDENSER $2.

RADIOTRONS UV202 $8.00 OR UV203 $30.00.

0-15 A.C. VOLTMETER. TYPE JX $8.00.

SOMERVILLE C.W. CONDENSER, 75c. OR R.C. UC 1014 CONDENSER $2.

KENOTRON RECTIFIERS UV216 $7.50. UV217 $26.50.

90 OR 260 TURNS 230 WIRE ON TUBE 2¼" DIAMETER.

FILTER CONDENSER, IDEAL 1000V. $2.00.

R.C.A. POWER TRANSFORMER UP1368 $25 For 5 watt TUBES or UP1016 $38.50. For 50 watt TUBES.

FILTER CONDENSER, IDEAL 1 MFD. $2; OR R.C.A. COND. 750 VOLTS, $1.85.

SOMERVILLE DIAL INDICATORS LEND DISTINCTION! NOW $1.75—WITH 3¼" DIAL, $1.60

RADIO CORP. & WESTINGHOUSE SALES AGENTS

SOMERVILLE RADIO LABORATORY
176-178 WASHINGTON ST., BOSTON, MASS.

GREBE & AMRAD STOCK DEALERS!

QST
Pittsburgh Amateurs!

You will find us in a position to supply your needs in radio supplies

Westinghouse, Amrad, DeForest, Acme, Murdock, Federal & Brandes
Complete Antenna and ground equipment.

——PARTS——

Come in and See Us
QUALITY

DEVON ELECTRIC CO. Inc.

Mail Orders Promptly Filled
SERVICE

613 LIBERTY AVENUE, PITTSBURGH, PA.

HOOK'ER TO YER BULB—TUNERS

A full page ad. could not do justice to our line of C.W. and phone equipment shown in our new 24 page catalog. Our tuners need no advertising. 10 cents brings catalog full of phone and receiving hookups, code, and other useful information.

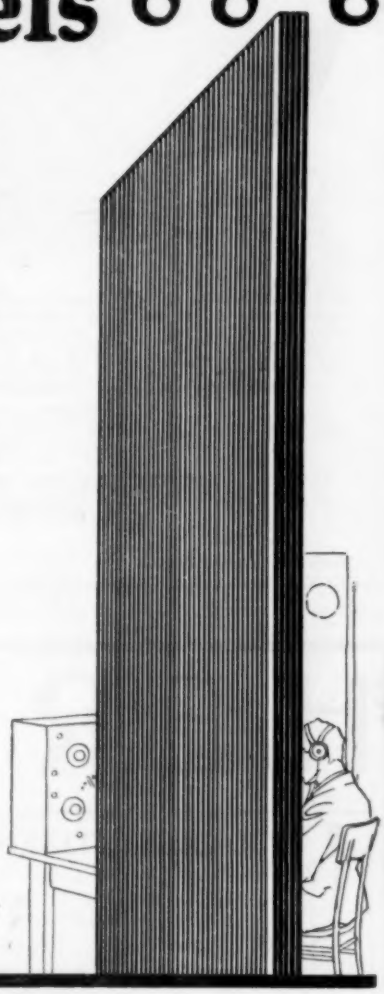
Tresco—Davenport, Ia.

The Highest Efficiency in Radio Panels

You get it in the Formica Panel. Extremely high insulation resistance and dielectrical strength result in low power and hysteresis losses where high frequency currents are employed. The angle of phase difference is unusually small.

High technical quality has led to the approval of Formica by the United States Navy and the Signal Corps.

Formica is handsome and highly finished. It is easily machined—and is impervious to weather, oil, water, acids, alkalies—permanent, durable, and always good-looking!



Dealers: Formica is the most popular panel material because of its good looks and high quality. You can buy it in standard sheets 32x46 and cut it yourself, or we will supply it at slight extra cost in 6x7, 8x9, 10x12, 14x18, 18x21 or any special sizes you want. We co-operate with the dealer. Write for our dealer helps.

The Formica Insulation Co.

4614 Spring Grove Ave., Winton Place,

CINCINNATI, OHIO

FORMICA

Made from Anhydrous Redmanol Resins

SHEETS TUBES RODS

R. F. AMPLIFICATION

at

Short Wavelengths

RECEIVER SENSITIVITY: Increased receiver sensitiveness can only be had by amplification of r.f. signal voltages before they reach the detector. This can be accomplished by conventional r.f. amplifier circuits or by regeneration, or by a combination of both.

DESIGN: MU-RAD R.F. AMPLIFIER TRANSFORMERS have been built upon two principles not hitherto utilized in such equipment, and combine regeneration and straight r.f. amplification uniquely in a single unit to give exceptional amplification. Our standard type T-11 transformer is built especially for amateur wavelengths where effective amplification is so difficult on account of tube and socket capacities.

TUBES: MU-RAD T-11 **TRANSFORMERS** must be used with Moorhead A-P tubes. The inter-electrode capacities and impedance of these tubes are especially suitable for short wave amplification and are utilized in our transformer and circuit design.

SOCKETS: Any of the standard tube sockets having diagonally mounted contact springs may be used, as the socket capacities in the various types do not vary sufficiently to affect the transformer operation.

OPERATION: Do not test these amplifiers on strong signals, but observe that stations absolutely inaudible with a detector and audio-frequency amplification (however great) come in loud and clear with a stage or two of MU-RAD amplification.

GUARANTEE: T-11 transformers, properly used, are guaranteed to give greater amplification than any other on the market. Purchase price refunded if users tests do not verify this claim.

Radio-frequency Amplifier Transformer, 160-500 M. with connection diagrams and instructions, Price $6.00

NO PLATE CIRCUIT TUNING ADJUSTMENTS—NO HOWLING—EQUALLY EFFECTIVE ON C.W., PHONE, SPARK

DEALERS: STOCK NOW—BIG DEMAND

MU-RAD LABORATORIES

Box 341
Asbury Park, N. J.

2801 N. Broadway
St. Louis, Mo.

HERE

RADIO CITIZENS

Complete stocks carried for immediate shipment of the following apparatus:

Grebe — Murdock
DeForest — Adams-Morgan
Acme — Radio Corporation
C. Brandes, Inc.
Federal Telephone & Telegraph Co.

FREE BULLETINS PRICE LISTS

Get the new lowest prices on apparatus and supplies. Bulletins and price lists mailed FREE on your request. Send for them today.

Nash Electrical Service Co.

Marshall, Ill.

Look, Sparks, Look!

Send us your orders for Amateur and Commercial wireless apparatus. Bulletin sent on request.

Our Wireless Department is supervised by a former radio inspector with wide commercial and government experience, who will advise you if desired, in the selection of radio apparatus. Please inclose stamp with inquiry.

Federal Specialty Co.

1337 Columbia Road,
WASHINGTON, D. C.

Another General Radio Accomplishment

TYPE 247 CONDENSER

For many years the General Radio Company has been supplying the research and educational institution laboratories throughout the country with high-grade radio apparatus suitable for research work. Only instruments of the finest quality are accepted in this class of work. The experience obtained in this line has enabled us to design instruments for the citizen radio field that represent the latest developments in engineering and mechanical skill.

The newest instrument in this line is the variable air condenser illustrated above. Here is an instrument of laboratory quality, yet selling at a price within reach of the experimenter.

Examine some of its features:

CAPACITY SCALE: In addition to regular scale divided into 100 equal divisions, the dial is also graduated in micromicrofarads, thus showing capacity at any setting.

LOW DIELECTRIC LOSS: Hard rubber is the only solid dielectric used. Quantity used is small and is so placed with respect to the electrostatic field that the dielectric hysteresis losses are kept a minimum. This is a very important feature in obtaining sharpness of tuning, and one which is commonly overlooked in condenser construction.

PLATES SOLDERED TOGETHER: Resistance is reduced and kept constant. Capacity, also, kept constant.

HEAVY ZINC PLATES ADEQUATELY SPACED: Danger of short circuiting minimized.

SPECIAL SPRING BEARINGS: Tension always remains the same. Good contact insured.

THRUST ALL IN ONE BEARING: No short circuiting if distance between bearings is changed.

LOW ZERO CAPACITY: Makes wide range possible.

METAL CASE GROUNDED TO ROTARY PLATES: Shields condenser, reducing capacity effects of hand while tuning.

You cannot afford to deny your set the advantages of this condenser. Give the long distance messages a chance.

Inspect this condenser at your local dealer's.

TYPE 247 CONDENSER, COMPLETELY MOUNTED, CAPACITY .001 MICROFARAD,

Price $5.50

MAY ALSO BE SUPPLIED UNMOUNTED FOR PANEL MOUNTING

SEND FOR FREE RADIO BULLETIN 909Q.

General Radio Company

MASSACHUSETTS AVENUE AND WINDSOR STREET.

CAMBRIDGE, 39 MASSACHUSETTS

Standardize on General Radio Equipment Throughout.

---it's in Dallas

Dear Fives:

We are entering another year in Radio together and I want to impress upon you that I can supply all the necessary apparatus you will need for any kind of installation, whether it be a small Harko crystal receiver or the latest in Grebe, AMRAD, Westinghouse, etc.

Come on fellows, let's show the northern birds that Radio in the Southwest is giving them nippity-tuck in the race; don't let them put in any better stations than you can. Buy all the "dope" you need from us and get it out in Service time, and if you need help with your trouble I'll be glad to extend it.

Wishing you a Happy and Prosperous New Year, I am,

Sincerely,

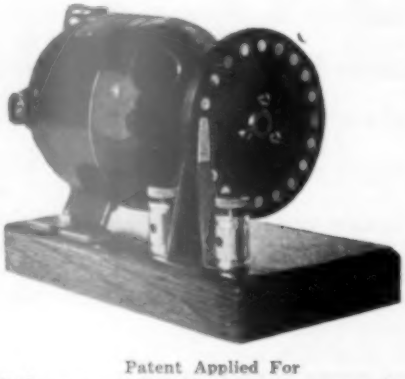
PORTER T. BENNETT,
Gen. Mgr.

The Southwest Radio Supply Co.

215 NO. ST. PAUL ST.

DALLAS, TEXAS

THE ROBERTSON CHOPPER



Patent Applied For

Wheel of Bakelite and brass. Of highest possible mechanical construction. Capacity 100 watts.
A high grade universal motor (D.C. and A.C.) 110 volt.
Altogether a perfect little beauty.
This Chopper gives the I. C. W. and a very pleasing note much easier to pick up than straight C.W. and which can, also, be picked up by all crystal detectors.

Complete with motor and base as shown.....$18.00
Wheel only, but including brushes and binding posts 6.50
(Give size of your motor shaft)

Send for bulletin describing our new Radio Key with Oil Cell. The finest key on the market. With marble base $7.50.

Other new Radio Devices coming. Send your name for our mailing list.

ROBERTSON CLOCK AND INSTRUMENT COMPANY
409 CONGRESS STREET, EAST, DETROIT, MICH.

SPECIAL FOR THIS MONTH ONLY

1 Crosley Socket FREE with every Electron Relay Bulb.
1 Ace 22½ volt B. Battery FREE with every Moorhead Amplifier Bulb.
Include postage for 3 lbs. Orders filled in rotation.

APEX RADIO SHOP. 1105 W. 69th. St., Chicago, Ill.

Symmetrical Designs For All Knobs

Shielded Dial and Knob

Not only are the GA-STD dials, of circularly polished german silver, 3" in diameter, the handsomest in appearance, but they are as effective shields as metal sheets behind the panel. The dial does not make contact with the shaft, but is grounded by a brush contact behind the dial. With this contact wired to the ground the hand has no effect upon CW signals. Moreover, the shaft hole, 1" deep, is long enough to take up any play that might cause the dial to turn out of true. And remember that the solid german silver will retain its glossy finish long after nickel plated or silvered dials have turned spotted and black. $\frac{7}{16}$" or $\frac{1}{4}$" hole furnished.

The handsomest dial you ever put on a panel.

GA-STD-A7 100-division dial and knob, post. 4c. **PRICE: $1.25**

GA-STD-A8 50-division dial and knob, post. 4c. **PRICE $1.25**

GA-STD-4 knob only, post. 3c. **PRICE $0.55**

GA-STD-5 100-division dial, post. 3c **PRICE: $0.70**

GA-STD-6 50-division dial, post. 3c **PRICE: $0.70**

Locked Lever Switch

The lever on the GA-STD switch, 1" radius, can never come loose because it is set into the molded knob. No extra-size drill is required to make a bushing hole in the panel because the $\frac{7}{16}$" shaft is smooth, not threaded. Thre is no lock nut at the rear to come loose —a collar and set screw take care of that. A contact surface equal to a $\frac{1}{4}$" square assures minimum resistance. The finest switch you ever used.

GA-STD-A9 switch, post. 3c. **PRICE $0.65**

Indicating Rheostat Knob

To match the other controls, the rheostat knob, with a white engraved line on the beveled edge, is made the same size as the switch knob. It can, of course, be used for other purposes where indications are required, with lines scratched on the panel. Shaft holes $\frac{7}{16}$" or $\frac{1}{4}$" are supplied. The knob is $1\frac{3}{8}$" in diameter at the base.

Improves the appearance of any rheostat.

GA-STD-12 rheostat knob, post. 3c **PRICE: $0.40**

FADA rheostat with GA-STD knob, post. 4c **PRICE $1.15.**

Notes

These knobs are guaranteed to surpass in finish and material any others sold to experimenters. They give to a receiving or transmitting panel a distinctive appearance in sharp contrast to the usual, miscellaneous types.

Radio and Model Engineering is the only monthly publication that is confined to articles on the construction of radio apparatus, and such apparatus as can be made of standard materials, with the facilities of the "kitchen table work shop." Edited by M. B. Sleeper whose articles in Everyday Engineering are familiar to every experimenter, Radio and Model Engineering brings to you each month the best articles on equipment you know will work because it is first built and tested.

Radio and Model Engineering is sold at all the radio stores. **Single copies 10c or $1.00 per year. Send in your dollar for a year's supply of real ideas.**

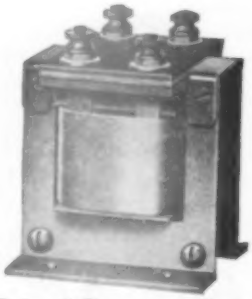
GA-STD

G.A. STANDARDIZED EXPERIMENTAL SUPPLIES

THE GENERAL APPARATUS COMPANY, Inc.

570-T West 184th Street **New York City**

NEW THORDARSON AMPLIFYING TRANSFORMER



Price fully mounted as shown

$4.00

Add PP on 1 lb.

Built by the world-famed transformer manufacturers and fully up to the high reputation and standard of all Thordarson products.

Outstanding Features

1—Eight months in building; tested and approved by Bureau of Standards.

2—Windings of large size *silk covered* wire, NOT enameled. No burnouts. Proper impedance secured by use of extra large core of shell type.

3—Ratio 3½ to 1. Primary and Secondary wound in separate sections and placed side by side on the core, not over each other. This gives most efficient coupling with very low distributed capacity and no tendency to howl even on 6 steps.

4—Considering the high standing of the maker and the very moderate price this is unquestionably the best transformer "buy" on the market.

In stock for immediate delivery—orders filled in rotation—send yours today. DEALERS:—Get our special discount on the Thordarson Amplifying Transformer—be the first in your locality to give your customers what they want. The demand will be heavy, place your order early.

Chicago Radio Apparatus Co., Inc.

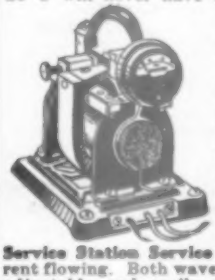
Phone Harrison 1716

508 SO. DEARBORN STREET, CHICAGO, ILL.

"Sole Chicago distributor FIRCO Radio Equipment"

10c. Charges Your Storage Battery AT HOME WITH AN F-F Booster

So U will never have to give up, in disgust when working a distant station. **Is it not gratifying to feel that your filament battery will always be ready when** you want it? YouKnowWhat its like to have friends call to "listen in" & then find your battery dead.



F-F Batttery Boosters are automatic and operate unattended. Screw plug in lamp socket, snap clips on battery terminals and see the gravity come up. The AMMETER shows you just the amount of current flowing. Both waves of current are rectified thru adjustable and easily renewable carbon electrodes which maintain a constant efficiency and last for thousands of hours. Everything Complete in One Compact, Self-Contained, Portable Charging Unit. F-F Boosters are Magnetic Rectifiers for 105-125 Volt 60CycleAlternatingCurrent. PRE-WAR PRICES: Bantam Type 6 charges 6 VoltBatteryat6Amperes$15 BantamType 12charges 12voltBatteryat5Amperes$15 Type 166 Charges 6 Volt Battery at 12 Amperes $24 Type 1612 Charges 12 Volt Battery at 7 Amperes $24 Type 1626 Charges Both 6 and 12 Volt Batteries $36

Service Station Service

Shipping Weights 12 to 15 Pounds

Order from your Dealer or send check for Prompt Express Shipment. If via Parcel Post have remittance include Postage and Insurance Charges. Or have us ship C.O.D. Other F-F Battery Boosters charge batteries from Farm Lighting Plants, Direct Current Circuits and D.C. Generators. For Group Charging use our Full Wave Automatic F-F Rotary Rectifier of 100 Volt, 36 cell capacity. Order Now or Write for Free BOOSTER Bulletin No. 31 or ROTARY 31A

The France Mfg. Co. OFFICES & WORKS CLEVELAND, OHIO, U.S.A.

Canadian Representative: Battery Service & Sales Co. Hamilton, Ontario, Can.

Plate Variometer $3.60 **Grid Variometer $3.60**

Vario-Coupler $3.00

SPECIFICATIONS: Designed for Panel mounting, ¼" Brass shafting used throughout. Wave length range 175-450 meters. Range may be increased to 650 by shunting secondary with special condenser.

KNOCKED DOWN SET of parts, as shown above with windings in place, for 8.75, two variometers and one vario-coupler.

SPECIAL: Assembled detector unit on formica panel for $4.45.

Amplifier unit for $8.20

Variometer unit, with knob and dial for $5.60. Vario-coupler unit, with knob, dial, and switch, $5. ALL PANELS COPPER LINED, (eliminating body capacity effect), and wired with #14 hard drawn copper wire. All wiring insulated with spagetti tubing.

SHORT-WAVE REGENERATIVE TUNER, Type CRS Something New. Most selective on the market. Wave length range—180 to 650 meters—Price $35.00.

WE PREPAY ALL SHIPMENTS. WE GUARANTEE YOUR ORDER TO BE ON ITS WAY TO YOU ONE HOUR AFTER IT IS RECEIVED BY US! Send for our bulletins. UNEXCELLED SERVICE—Our Motto.

HIGEE RADIO MFG. CO.
Marion, Ill.

WESTINGHOUSE WJZ

Uses A-P TUBES for efficiency

In the Westinghouse Receiver Cabinet at the Westinghouse High-Power Radio Telephone Broadcasting Station in Newark, New Jersey, the Westinghouse Electric & Mfg. Company are using A-P Tubes EXCLUSIVELY—the A-P Electron Relay, the most sensitive detector of spark signals known to the radio art, and the A-P VT Amplifier Oscillator, the tube the U. S. Navy uses. Westinghouse operators, and others who know, find that A-P Tubes not only take less filament current than any other tube on the market, but are by far the most sensitive.

In **your** set, use the tubes that Westinghouse uses. Use the tubes in operation at WJZ. Use A-P Tubes for efficiency—the tubes that are used by those who know.

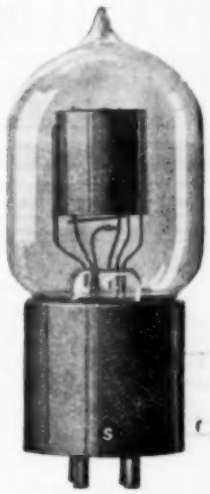
THE A-P VT AMPLIFIER OSCILLATOR

—The Amplifier used by the U. S. Navy. "Use the tube the Navy uses." Price $6.50

the tubes that are used by those who know

Paul F. Godley chose A-P Tubes for the supreme International test. The Magnavox Company designed its new Power Amplifiers for use with A-P Transmitter Tubes exclusively. Where efficiency is required A-P Tubes are chosen by those who know. There is an A-P Tube for every use. Use A-P Tubes for efficiency.

And for the best book on Radio ask your dealer for "Elements of Radio Telegraphy" by Lieut. Elery W. Stone, U. S. N. price **$2.50**



THE A-P ELECTRON RELAY

—the most sensitive detector of spark signals known to the radio art. Price $5.00

A-P Tubes are licensed by the Radio Corporation of America under DeForest Audion and Fleming patents for amateur and experimental use in Radio communication.

Order from your dealer or direct from

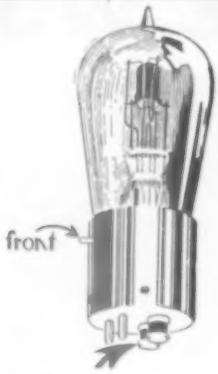
ATLANTIC-PACIFIC RADIO SUPPLIES COMPANY

NATIONAL DISTRIBUTORS FOR THE MOORHEAD LABORATORIES, INC.

638 MISSION STREET—SAN FRANCISCO—CALIFORNIA

HENRY M. SHAW—President

use A-P tubes for efficiency



Slips on easily with fingers.

Let High Amperage "Try and Get" Your Tube

—you are fully and absolutely protected against "burning out" even from an accidental short when you guard your vacuum tube with the

RADECO

Pat. Pending.

SAFETY FUSE

—a tiny bulb protector that slips directly on the filament terminals of any standard bulb used in any standard socket and makes fusing of the filament impossible.

Size: ¼" over all. Carrying Capacity: 1, 1¼, 1½, 2, 2½, and 3 amperes.

ORDER TO DAY FOUR FOR $1.00 BY MAIL OR FROM DEALER

WANTED!
"BURNED OUT" VACUUM TUBES

For display use in advertising the Radeco Safety Fuse, we desire a number of "burned out" bulbs. Any make of tube will suit the purpose so long as the glass is whole and the socket uninjured.

We will therefore allow 50c toward the price of a new tube for any old tube received in usable condition for display. In sending in such tubes pack carefully to protect the glass. We carry a full line of Standard Tubes at Standard Prices.

RADIO EQUIPMENT CO., 630 Wash'n St., Boston, Mass.

U OF I SUPPLY STORE SERVICE
DERN HUSBAND GETTING MORE JUNK AND I NEED SOCKS
WAIT OW! WITHER BOUND?
I MAY BE OLD BUT THESE YOUNG SPRITES AINT GOT NUTHIN ON T.O.M.
MEOW

Z-NITH
ACME
DEFOREST
BENWOOD
AMRAD
TRESCO
CUNNINGHAM
KLAUS
RAY-DI-CO
BALDWIN
PACENT
FEDERAL
BRANDES

QUALITY **SERVICE**

4 cents brings bulletins.

THE U. OF I. SUPPLY STORE
627-29-31 WRIGHT STREET,
CHAMPAIGN, ILLINOIS

MURDOCK
BURGESS
TUSKA
ACE BATTERIES
MARKO
ADAMS-MORGAN
NEWMAN-STERN
A. P. TUBES
REMLER
SOMERVILLE
J-RAY
WESTINGHOUSE
CHI-RAD

RADIO CLUB PINS

Radio Clubs Everywhere have a special club pin. We make them to order, 25c to $10.00 each. 1922 catalog of 48 pages showing designs of Radio, School and fraternal pins and rings FREE. Samples loaned to officers.

Metal Arts Co., Inc. **7753 SOUTH AVE., ROCHESTER, N.Y.**

ANNOUNCING

Our New Address,
HANOVER, N. H.
ACE "B" BATTERIES, 95c
Postage on 2 lbs. extra

A.K.Laing Radio Co.

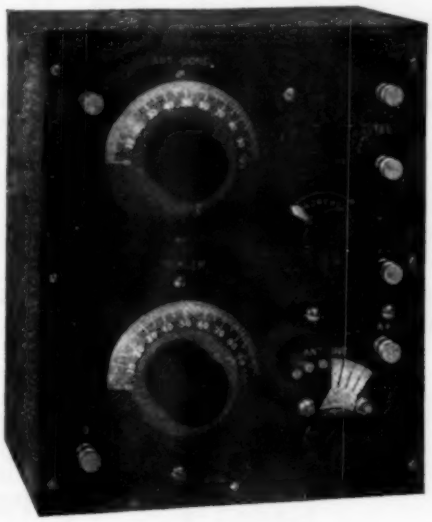
Type HR
Regenerative Receiver

Wavelength 180-825 Meters. Perfect Regeneration at all wave lengths. No capacity effect from the hand or body. Antenna condenser built as a vernier. Compartment inside cabinet for "B" Battery or External "B" Battery may be used. The control is wonderfully simple—the best you have ever used.

We absolutely guarantee this set to give results equal or superior to any on the market regardless of price.

We absolutely guarantee this set to give results equal or superior to any on the market regardless of price. Set includes tube socket and rheostat and is completely wired ready for use. Cabinet of dark oak with hinged cover. We believe it represents the greatest value ever offered in radio and the owner of this set will have a surprise for the owner of more expensive equipment.

Remember you can not buy greater performance at any price and this equipment is backed by the oldest manufacturers of radio in the United States. Order from your dealer or from us if he won't supply you. You don't have to experiment with unknown products unless you want to. The price of H. R. Regenerative Receiving Set complete with tube, B Battery, 2000 ohm telephones and storage battery, $65.00, includes everything except antenna and ground.



NEXT MONTH WE WILL SHOW IN THIS MAGAZINE ANOTHER UNUSUAL DEVELOPMENT — WATCH FOR IT!

Our complete catalog in three parts is full of equally attractive items and describes every radio essential from the smallest item to the largest.

COMPLETE SET $35.00

Licensed under Armstrong U. S. Patent 1113149

CLAPP-EASTHAM COMPANY

RADIO ENGINEERS *and* MANUFACTURERS

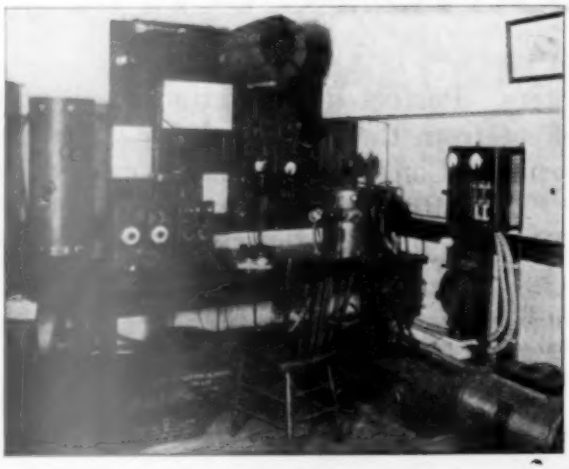
114 MAIN STREET, CAMBRIDGE, MASS.

California Representative: Leo J. Meyberg Co., San Francisco and Los Angeles.

127-12

"QRA" PHILADELPHIA SCHOOL OF WIRELESS TELEGRAPHY PW "3YG"

Reg. U. S. Trade Mark



2KW Federal Arc Transmitter in corner of class room.

Wave length 300, 600, 2000, 2700 meters

We have without a doubt the most up-to-date Radio School in the East, having in actual operation—Spark, Arc, and Bulb Transmitters. Booklet Q Free.

Philadelphia School of Wireless Telegraphy

Jobbers and Dealers in Everything Radio

1533 Pine St., Phila. Pa.

Our Own 5 Story Building—Every Improvement

A C E Type AVC Regenerative Receiver A C E

Ideal for either voice, CW, or spark reception over maximum distances.

Price **$56.00**

(Licensed under Armstrong Patent 1,113,149)

"QUALITY AND EFFICIENT PERFORMANCE"

are the essential features to be considered when purchasing radio equipment.
We stock a complete line of Radio Supplies and maintain a *prompt, reliable* Mail Order Service that reaches all over the world.
Send 5c in stamps for catalog to Dept. "D".

The Precision Equipment Co., Inc.

Manufacturers & Distributors of Radio Apparatus

Peebles Corner, Cincinnati, Ohio

Cable Address ACE Cincinnati — Radio 8XB

Prepared Radio Measurements

with

Self Computing Charts

by Ralph R. Batcher

A new WIRELESS PRESS book. Published as a real help to amateur radio. Obviates the necessity of long and involved mathematical calculations. A ruler or transparent triangle takes the place of intricate figuring and the results will be correct every time.

PRICE $2.00

***The* WIRELESS AGE**

The magazine that meets all your expectations.

When its new you find it in the AGE. Every step in radio progress is fully and carefully described. You miss a lot of good things unless you read the AGE. **$2.50 per year, Postage outside U. S. 50c.**

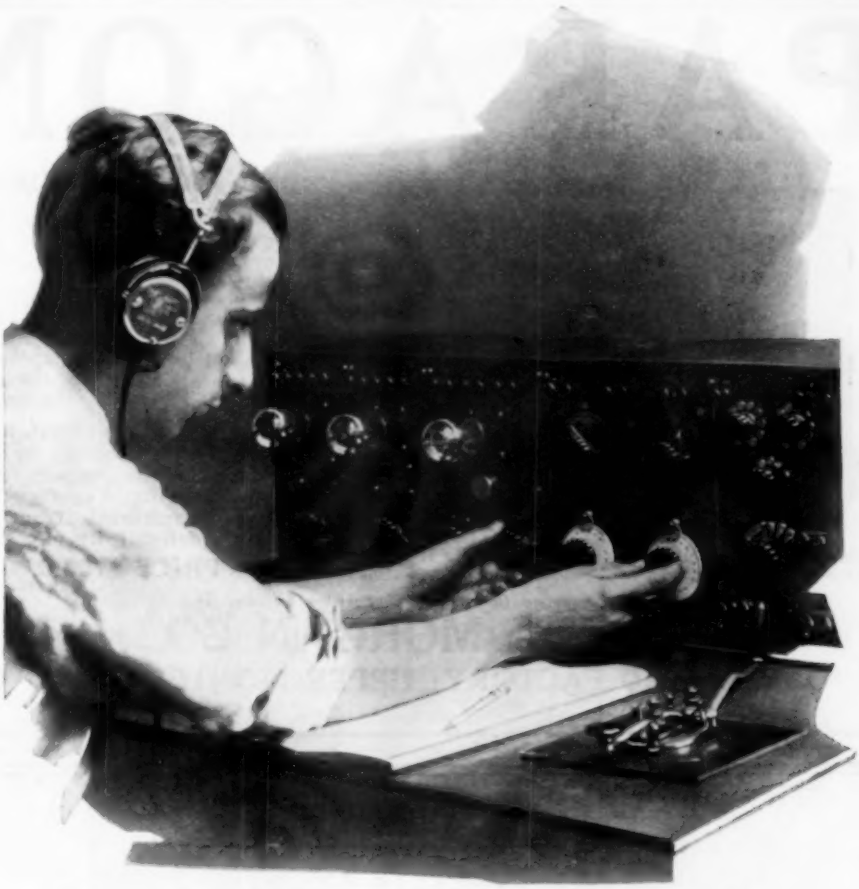
SPECIAL OFFER ONLY

Prepared Radio Measurements & The Wireless Age 1 Year **$4.00** Outside U S. 50c. Extra

This offer expires Dec. 15, 1921.

WIRELESS PRESS INC.

328 Broadway, New York



Condensite Knobs and Dials Indicate Quality

Manufacturers of Radio equipment do not use Condensite to reduce prices, they use it as a means of building up a reputation for dependable products.

Condensite has all the properties essential to good electrical insulation, high dielectric strength at radio frequencies, low phase angle, mechanical strength, chemically inert, readily machined, and a permanent lustrous finish.

We will be glad to send upon request the names of the firms who make their radio equipment of Condensite.

Molded Condensite is fabricated by our licensed customers. Names on application.

Condensite - Celoron is a water-proof fibre manufactured by the Diamond State Fibre Co., Bridgeport, Pa.

CONDENSITE COMPANY OF AMERICA

BLOOMFIELD NEW JERSEY

PARAGON

PARAGON RADIO TELEPHONE TYPE 2-5-U
(Licensed under Armstrong Patents) (Patents Pending)

DISTANCE RECORDS

Phone: Babylon, N. Y. to Ocean City, N. J. daylight (10 A.M.) 125 miles 2 5 watt tubes.

CW and Buzzer: (1 5 watt tube) Cedar Grove, N. J. to Savannah, Ga., Norfolk, Baltimore, Philadelphia, Indianapolis, Ft. Wayne, Peoria, Cleveland, Buffalo, Toronto, Boston, Etc.

Highly Efficient; remarkably flexible; voice, buzzer, or CW; instantaneous access to 7 wave lengths; a perfect "short haul" universal transmitter that's delightfully effective.

PRICE $70.00

DEALERS: We have an interesting proposition to offer you. Write us.

ADAMS-MORGAN CO.,

OFFICE AND FACTORY: UPPER MONTCLAIR, N. J.

DEALERS AND RADIO CITIZENS

Order Your Needs From Our

LARGE AND COMPLETE ASSORTED STOCK

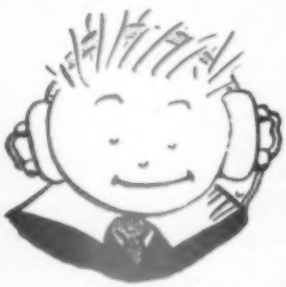
PARTS OF ALL KINDS **COMPLETE SETS**

LARGEST STOCK RADIOTRONS AND KENOTRONS IN U. S. A.
ALL TUBES SHIPPED PREPAID

Write for our new price list No. 100-T

LUDWIG HOMMEL & CO.

LUDWIG HOMMEL & CO.
530-534 Fernando St.,
PITTSBURGH, PA.



Read the "DIARY OF A HAM"

Appearing Each Month in

"CANADIAN WIRELESS"

(ONE DOLLAR A YEAR)

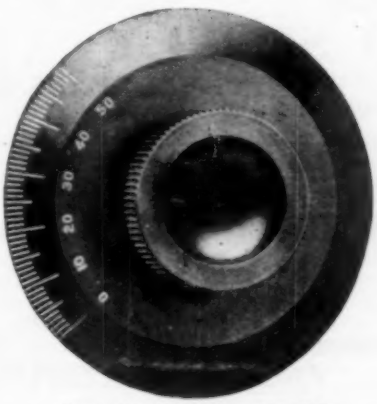
Scientific Experimenter

LIMITED

33 McGill College Avenue, **Montreal, P. Q.**

Write for Catalog of Wireless Supplies

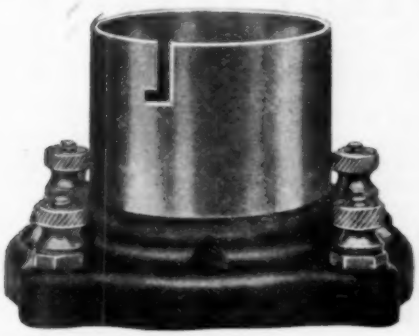
Our New Home



No. 41 DIAL—$1.00

No. 3 CONDENSER $4.75

No. 50 AMPLIFIER $4.50



No. 60 SOCKET $1.00

CHELSEA RADIO CO., CHELSEA, MASS.

RADIO APPARATUS

LARGEST STOCK SOUTH

SERVICE — **PROMPT DELIVERIES** — **QUALITY**

B. Batteries Radisco Small 22½ V.	$1.50	Sockets Paragon	$1.00
B Batteries Radisco large-tapped 22½ V.	2.65	Sockets Murdock	1.00
B Batteries Eveready large-tapped 22½ V.	3.00	Sockets G.A.	1.50
Tubes UV200 Radiotron Detector	5.00	Sockets DeForest	1.20
Tubes UV201 Radiotron Amplifier	6.50	Rheostats Paragon	1.50
Tubes UV202 Radiotron Trans-5 watt	8.00	Rheostats DeForest	1.65
Tubes UV203 Radiotron Trans. 50 watt	30.00	Rheostats Gen. Radio	2.50
Tubes C300 Cunningham Detector	5.00	Rheostats Remler-Jr.	1.00
Tubes C301 Cunningham Amplifier	6.50	Remler Rheostat	1.50
Tubes Electron Relay Detector	5.00	Rheostats Parkin	.75
Tubes A & P Amplifier	6.50	Corwin Dial & Knob 3"	1.00
Phones Murdock 2000-ohm	4.50	Corwin Dial & Knob 3⅞"	1.20
Phones Murdock 3000-ohm	5.50	Dial and Knob Chelsea	1.00
Phones Brandes Superior	8.00	Transformers, Acme Unmounted	4.50
Phones Brandes Navy	14.00	Transformers, Acme Semi-mtd.	5.00
Phones Baldwin Type C	13.75	Transformers, Acme Mounted	7.00
Phones Baldwin Type E	15.00	Transformers, Federal	7.00
Phones Baldwin Type F	16.25	Transformers, UV712	7.00

We have only listed a few items above, can furnish anything required for your set—we stock only high grade products.

Acme Apparatus	Federal	Brandes	Remler
Clapp-Eastham	Firth	Adams-Morgan	Signal
DeForest	Radio Dist. Co.	Chelsea	Eveready
Wm. Murdock	Radio Corp.	Magnavox	N. Baldwin Co.

ROSE RADIO SUPPLY

604 GRAVIER STREET, **NEW ORLEANS, LA.**

Send 10c for Catalog.

SPEEDY SERVICE

When you want any standard make of radio instrument, and you want it quick, call on us. Shipping goods in a hurry is the best thing we do!

DeForest EVERYMAN Radio Receiver:

A complete crystal detector outfit for receiving wireless telephone concerts, news, sporting results, crop reports, etc. Price $25.00. Aerial equipment $6.50 extra.

SPECIAL—

Storage batteries, 6 volt, 60 amperes, regular price $18.00—now only $14.40. *Order at once, supply limited.*

FEDERAL PLUG—

Something new, fits any type of cord tip $1.75.

VOCALOUD—

The sensational loud speaker that requires no batteries, no adjustments, no extras. Station type in solid mahogany cobinet at manufacturers price.

KELLY & PHILLIPS 312 Flatbush Ave., BROOKLYN, N. Y.

WHEN U WANT STANDARD APPARATUS BUY FROM

RAY-DI-CO

ABC UNIT RECEIVERS

Receiver unit	$13.50
VT Detector unit	11.25
1 Step amplifier	14.75

BALDWIN RECEIVERS

Type C	$12.00
Type E	13.00
Type F	14.00
Type G	15.00
Single units	8.50

Paragon RA-10 receivers	$69.50
Combination detector and two stage amplifier	65.00
Paragon radiophone	70.00
Ray-Di-Co motor generators 15 to 250 watts	$42.35 to $157.50

MAIL ORDERS GIVEN PROMPT ATTENTION

THE RAY-DI-CO ORGANIZATION

1547D N. Wells St., Chicago, Ill.

Who Knows?

Who know what a piece of apparatus is worth without actually trying it? Who can tell how long a piece of apparatus will last, what kind of service it will give, merely by looking at it? No one. But you can do this for your protection—**buy all your apparatus from the California Electric Supply Co.,** who guarantee every bit of equipment they sell, and who stock such standard, nationally known lines of proven worth as DeForest, Kennedy, Clapp-Eastham, Magnavox, etc. You **do know** the value and serviceability of apparatus you buy of the California Electric—"Radio Supplies that R Right."

THE RADIO MAGNAVOX

"The Reproducer with the Movable Coil," the only loud speaker which will reproduce Radio speech, music and messages in any volume desired without distortion and without injury to the apparatus. Printed instructions and diagrams free with each outfit.
Type R-3 Magnavox, with the new 14" horn, rated input 5 watts, uses one ampere in field—price complete—**$45.00**
Type R-2 Magnavox, with 22" horn, rated input 20 watts, uses one-half ampere in field, price **$110.**

MAGNAVOX 2 and 3-STAGE NEW POWER AMPLIFIERS

The volume to be attained from your Magnavox depends upon the power input. The New Magnavox Power Amplifiers assure your Magnavox getting the largest possible power input. Can be used with any transmitting tube with any voltage up to 1000, and sets either flat or on ends. Master switches, no jacks.
Type AC-2 Model C Magnavox 2-Stage Power Amplifier, in solid mahogany case **$80.**
Type AC-3 Model C Magnavox 3-Stage Power Amplifier in solid mahogany case **$110.**

Special temporary low prices on the following five DeForest items:

DeForest CV 500-.0005 Condensers	$3.70
DeForest LC 101 Coil Mounting	9.25
DeForest P 300 Detector and 1 Stage Amplifier	40.00
DeForest T 200 Tuner	50.00
DeForest P 100 Audion Control	35.00

The items listed above are but a few from our large stock of standard apparatus.

No matter where you are situated you can buy ALL your apparatus here and be assured of getting "Radio Supplies That R Right". We ship anywhere in the U. S. or abroad. Those who live in the vicinity of San Francisco will note our convenient location in the heart of the business district.

California Electric Supply Company

643 Mission St. - San Francisco, Cal.

- Radio Supplies that R right -

'Co-Operation'

Buy your radio parts and finished instruments from this association and secure prompt, satisfactory SERVICE as well as considerable money SAVING. Try us with a trial order or send stamp for detailed information. You can secure membership without cost and participate in the associations profits on any radio purchase you make.

Dept. Q-1

BALDWIN PHONES (Reduced Prices)
Type C. small style.....$13.75
Type E. ultra-sensitive..... 15.00
Type F. very small style..... 16.25

STORAGE BATTERIES.
Marko 6 v. 20-40 ampere hour...$14.60
Marko 6 v. 40-60 ampere hour... 17.00
Marko 6 v. 60-80 ampere hour... 21.50
Marko 10 v. 60-80 ampere hour.. 40.00

AMPLIFYING TRANSFORMERS.
Federal, small compact.....$8.75
Radiotron, UV-712 model..... 7.00
Saco-Clad, very small..... 5.00
Acme, new mounting..... 5.00
Clapp-Eastham, fully mounted..... 4.00

VACUUM TUBES.
Radiotron UV-200 detector.....$5.00
Radiotron UV-201 amplifier..... 6.50
Radiotron 5 watt power tube..... 8.00
Moorhead Electron relay..... 5.00
Moorhead Amplifier 6.50

MURDOCK CONDENSERS.
.001 mfd. in rubber case.....$4.75
001 mfd. transparent case..... 4.50
0005 mfd. transparent case..... 4.00
.001 mfd. for panel mounting..... 4.00
.0005 mfd. for panel mounting.... 3.25

Mutual Purchasers Assn.

2-4 Stone St., New York City

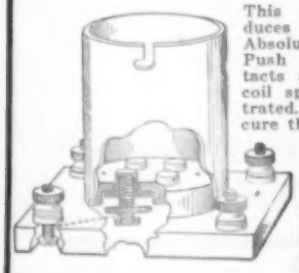
Announcement

Our new catalogue #22 is just off the press.

Write for your copy today. The supply is limited so DO IT NOW!

SERVICE RADIO EQUIPMENT

403 Madison Ave., Toledo, Ohio



This Socket introduces the latest in Absolute Reliable Push Button Contacts actuated by a coil spring as illustrated. You can procure this patent feature instru- for $1.00 only the price for ordinary sockets. The U. S. Patent Office permitted us to use the motto "On Top of All" in association with our wireless apparatus, etc., same being of high quality.

7½c ea.

Shaft solid embedded in Knob Cannot work loose.

45c *Prepaid*

Lever 1¾" radius Guaranteed not to work loose here either. Note the secret.

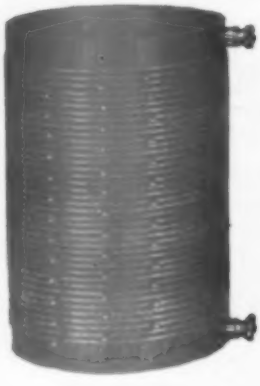
CONTINENTAL ELECTRIC CO., 117 East 129th St., N., New York, N.Y.

Confucius has said:
"The accomplishment
of great things
consists
In doing small things
Well"
Perfection of
detail
makes the
Grebe Receiver
What
it is-

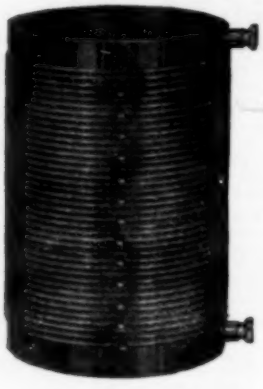
The Grebe CR-5 Receiver

GREBE RADIO
Doctor Mu.

Tuska Moulded C. W. Inductances



Type 187—$4.65



Type 186—$4.15

Type 185—$3.15

This latest Tuska development consists of a **moulded inductance** form four inches in diameter and six inches long. The threads for the wire are also moulded in, which insures not only a perfect mechanical process but the dielectric losses are less than in the case of a machined product.

The inductance is supplied in three forms as shown. The models are wound with No. 12 soft drawn copper wire. This will carry an average load of 50 watts. The inductances are tapped every third turn or every turn in which case they are staggered in three rows.

We are proud of this latest Tuska Product and invite you to inspect it at your dealers. The latest Tuska Catalog No. 2 is out and shows several new Products. Send 5 cents in stamps.

THE C. D. TUSKA COMPANY, 10 Hoadley Place, Hartford, Conn.

"WHAT IS IT??"

Something new in RADIO

—Ask your dealer about it.—

It is the new BALWIN RADIO FREQUENCY TRANSFORMER, which will help bring in signals that you never before heard, and will cut out interference. They are designed to work on wave lengths of from 200 to 250 meters, and can be used in as many steps of RADIO FREQUENCY AMPLIFICATION as desired. These transformers are selling at $3.50 each, and a complete circuit, and also a wave length chart, is furnished with each purchase.

Can be obtained from the following dealers: *Manhattan Electric Supply Co.; J. H. Bunnell & Co.; American Electro Technical Appliance Co.; Continental Radio & Elec. Corp.; Beacon Radio Co.; H. Goldberg, New York City; Kelly & Phillips, Brooklyn, N. Y.; F. D. Pitts Co., Inc., Boston; Atlantic-Pacific Radio Supplies Co., San Francisco.*

If your dealer cannot supply you, write direct to us, giving his name.

——Manufactured By——

BALDWIN RADIO ELECTRIC MANUFACTURING CO.

1516 Emmons Ave., Sheepshead Bay, BROOKLYN, NEW YORK.

The Hit of the ARRL Radio Show at Chicago Was the "J-K" MICROPHONE

Type M-3, Hand $6.00

Type M-2, Panel $4.00

Type M-1, unit only $3.00

You CW men after DX records should ask for them at your dealers or direct from

Type M-3

Priced Right and Made Right

JOY and KELSEY

4021 W. KINZIE ST., CHICAGO, ILL.

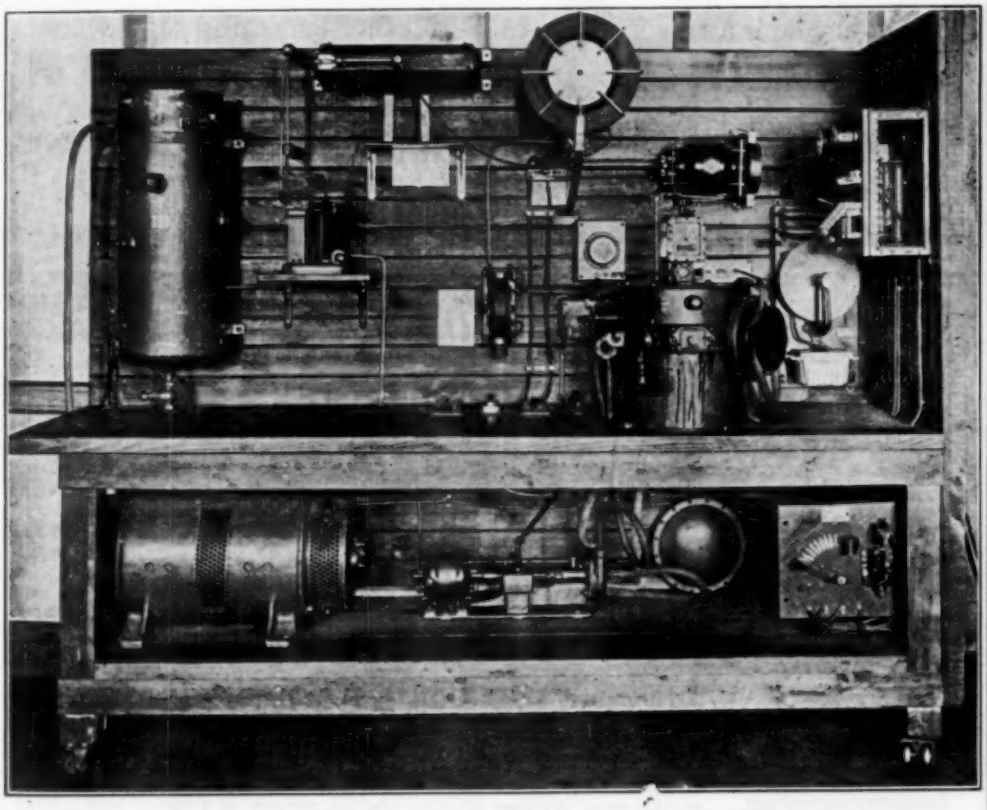
TEL.
BACK BAY
5964

898 BOYLSTON ST.
BOSTON, MASS.

SPARK---A R C---VACUUM TUBE

The Revised Examination for Commercial Operators including ARC and VACUUM TUBES is carefully and fully covered by the Course of Instruction offered by the EASTERN RADIO INSTITUTE.

Intelligent students INSIST on being taught upon ACTUAL apparatus!



"The EASTERN RADIO INSTITUTE'S 2 K.W. 'ARC'"

The EASTERN RADIO INSTITUTE is the OLDEST, LARGEST and BEST EQUIPPED Radio school in New England. The Pioneer school that has always led the way! Ask any man in Radio—he will tell you!

New Students can begin to advantage in the Day or Evening school on any Monday.

REMEMBER:—Our ORGANIZATION with YEARS OF PHENOMENAL EXPERIENCE and SUCCESS is behind every man who enrolls! Ask any man in Radio—he will tell you! OVER 4000 satisfied graduates TELL OUR STORY BEST! Why not be one?

Our illustrated prospectus is free. If you cannot visit the Institute send for one.

F. D. PITTS, Director

The Big Event of Radio

The Second Annual Convention and Radio Show of the Executive Radio Council, Second District, will be held at the Pennsylvania Hotel, New York, March 7 to 11, 1922, inclusive.

Last year's convention and show was the biggest affair of the kind ever put over in the history of radio. When you read, in next month's issue, of all the wonderful things to be shown, talked about and done this year, you will immediately realize that this year's affair is going to be another smashing big success.

Executive Radio Council
Second District

STERLING 9BGE

MINNEAPOLIS

RADIO 9BGE

WE REPRESENT THE BEST IN RADIO

X BALDWIN X		AMRAD		RADIO CORPORATION
Type C	$12.00	New Det. & 2 Stage Ampl.		C-W Equipment
Type E	13.00	New Regenerative Rec.		One Combination Grid
Type F	14.00	Twin-R-Sinc Motor	$25.00	Leak and Condenser With
Type G	15.00	Wavemeter	13.50	Every Tube FREE!
Speaker Unit	6.00	Bunnell Key	4.00	UV200 $5.00, UV201 $6.50
Headband	.75	Ampliformer	3.75	UV202 8.00, UV203 30.00

WE ARE JOBBERS—DEALERS GET OUR PRICES—CATALOGUE 25c

STERLING ELECTRIC CO., 33 So. 5th St., Minneapolis, Minn.

WE USED OUR BEAN

In Designing

THE PARKIN DIAL TYPE RHEOSTAT (Pat. pending) and by mounting the resistance element in a circular groove in the back of a 3" molded Bakelite dial eliminated one part and saved you the cost of a dial. The groove being recessed, allows the dial to clear the panel by the usual distance of $\frac{1}{4}$". An off position is provided and a stop on the dial engages the stationary contact at the extreme positions. The 360 degree rotation insures fine adjustment. A brass bearing insures a true running dial and smooth action.

All figures and graduations are filled with brilliant white enamel. All brass parts nickel plated. Bakelite knob.

Resistance is 5 ohms, carrying capacity 2 amps.

No. 77 Parkin Dial Type Rheostat **Postpaid $1.75**

FOR SALE BY ALL LEADING DEALERS

Send for free catalog No. 4 describing our complete line.
DEALERS: Write for proposition.

PARKIN MFG. CO., San Rafael, Calif.

Westinghouse Radio Apparatus

"Vocarola"

The loud speaker attachment that amplifies music without distortion.

$30.00

Westinghouse Electric & Manufacturing Co.

East Pittsburgh, Pa.

Westinghouse

Condensite celoron

Makes Good Radio Equipment Better

Insulation is the foundation of all radio. Your equipment can only be as efficient as the insulation you use in its construction. Condensite Celoron is the safest, surest and most successful answer. There are several salient reasons why.

Condensite Celoron is high in resistivity and dielectric strength, extremely water resistant, immune to atmospheric and climatic conditions, insoluble, infusible, long-lasting and attractive. Read this bureau of Standards test:

Wave Length Meters	Approximate Frequency Cycles per Second	Phase Difference Degrees	Dielectric Constant—K
373	804,000	2.0	4.7
1,295	231,500	1.8	4.8
3,067	97,800	1.8	4.9

We supply this remarkable material in standard size sheets, rods and tubes ready for all machining purposes—for experts and amateurs. Sold by radio equipment dealers everywhere. If your dealer cannot supply you, write us.

Diamond State Fibre Company
Bridgeport (near Philadelphia,) Penna.

Branch Factory and Warehouse, Chicago
Offices in Principal Cities
In Canada,
Diamond State Fibre Co. of Canada, Ltd., Toronto

Using An Inefficient Radio Set Is A Disappointment

We won't disappoint you because we handle the things that are really worth while in Radio. Our stock includes receiving and transmitting apparatus desirable for Spark, C.W. and Phone made by:

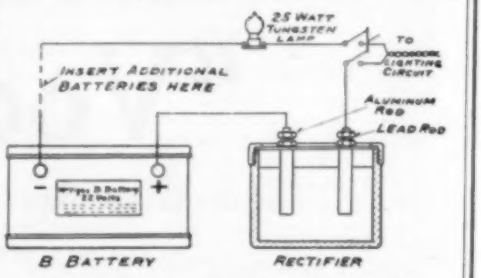
Grebe	Pacent
Westinghouse	Cunningham
Acme	Tuska
Burgess	Federal
Magnavox	Clapp-Eastham
Remler	Baldwin
Chelsea	Jewell
Murdock	

Pioneer makers of Andrae Telephones. In business 60 years.

Our service is of the best and the quality of our goods unquestionable. Identified with telephone and electrical development of the Northwest since its beginning.

Julius Andrae & Sons Co.
119 Michigan Street,
MILWAUKEE

The McTighe Storage B Battery



We Announce the New Improved McTighe Storage B Battery

The new Battery is of the alkaline type and is practically indestructible. Its capacity is ample for a several stage amplifier and a one hour charge will last for several weeks in ordinary service. No injury is caused by accidental short circuit or by standing idle.

The Battery is contained in an attractive black metal case 5 inches diameter, 3 inches high. Cells are held rigidly in place and tight metal cover prevents evaporation.

As many as four units in series can be charged from one rectifier on 110 volt A.C. lighting circuit.

Write for descriptive leaflet, or better, order a Battery and rectifier today.

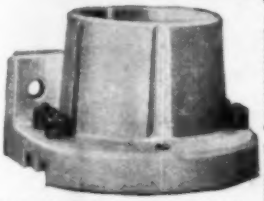
Battery	$3.50
Rectifier	1.25

Postage and packing 20c extra

McTIGHE BATTERY COMPANY
WILKINSBURG, PA.

CROSLEY VT SOCKET 60c

Better—Costs Less



The reason for its tremendous success is not low price, but because it is BETTER. The bayonet catch is now imbedded in a much heavier wall instead of being cut clear through. This eliminates the possibility of breakage through careless handling. The whole socket has been greatly reinforced. It is now practically unbreakable. Dropping it on the floor will not break it. The springs are phosphor bronze, nickel-plated; screws and nuts brass nickel-plated.

It is built for base or panel mounting, an exclusive feature. It is the prettiest thing you ever saw assembled in a set. Now used by several manufacturers as standard equipment. Made of one piece porcelain: no metal shell, hence no ground hum. Better for power tube work, as it withstands heat and will not melt. Patent pending.

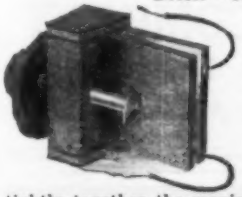
Every progressive dealer now handles the CROSLEY VT SOCKET or will obtain them for you. If your dealer can't supply you, send us his name and order direct. We will ship prepaid.

Every socket is GUARANTEED to give satisfaction or money refunded. Patent pending.

The Crosley Variable Condenser

Pat. Pend.

Better—Costs Less



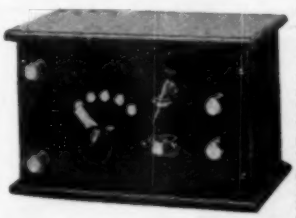
This Condenser works on an entirely new principle. The two plates are hinged and are opened and closed like a book by means of a specially designed cam. The plates are surfaced with copper. One copper sheet is covered with mica so that when the two plates are clamped tightly together the maximum capacity is obtained. The maximum capacity of this Condenser will average about .0008. We rate it conservatively, however at .0005.

This Condenser has several advantages over the ordinary type of air condenser. Will stand 1000 volts without breaking down. It can therefore be used for CW work. Has no body or hand capacity effect. Has much greater signal strength due to the fact that mica is a much more efficient dielectric than air, due to less resistance. The calibration curve of this Condenser is almost a straight line. Has unusually low zero capacity—.00006.

Price without knob and dial $1.25
With knob and dial 1.75
Mounted in cabinet with knob and dial 2.50

Sold on a GUARANTEE of absolute satisfaction or money refunded. Ask your dealer.

HARKO RADIO RECEIVER



The most compact and complete efficient crystal receiving outfit on the market. Designed for the amateur who wishes to get started in this wonderful game. The illustration shows complete outfit ready to hook to aerial, fones and ground wire.

Will tune from 200 to 600 meters, bringing in spark, voice and music with average amateur antenna. NAM, Norfolk, Va. and ships at sea copied in Cincinnati.

A wonderful little instrument. Price complete with battery, interrupter for testing crystal, instructions, etc. $9.00. One thousand ohm single head set, 125 ft. antenna wire, insulators, etc. $6.00 extra. Complete outfit $15.00.

Crosley Cabinets

The tendency in the radio field today is to put apparatus in cabinets not only for appearance's sake, but as a protection from dust, dirt, atmospheric conditions etc. Realizing the demand for attractive stock cabinets of various sizes, we are building them in quantities in our large wood working plant. These cabinets are all uniform in style. The panels are rabbated in to the front. As the outside dimensions and inside dimensions are either larger or smaller than the panel itself, we show panel size and also inside dimensions. Prices quoted do not include the panels. Wood used is either gum or mahogany in dark antique or red mahogany finish or in quartered oak in natural or antique finished. Specify type of wood and finish in ordering. Lids or tops are hinged. Sizes and prices are:

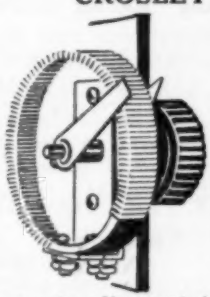
For Panel Size	CABINETS Inside Dimensions High	Wide	Deep	Mahogany or Quartered Gum	Oak
6x7	5 1/8"	6 1/2"	7"	$2.50	$3.85
6x10 1/8	5 1/8"	10"	7"	2.75	4.40
6x14	5 1/8"	13 1/2"	7"	3.30	5.55
6x21	5 1/8"	20 1/2"	7"	3.90	7.30
9x14	8 1/2"	13 1/2"	10"	3.70	6.80
12x24	11 1/2"	13 1/2"	10"	4.40	6.80
12x21	11 1/2"	20 1/2"	10"	5.25	10.60

Cash must accompany order. No C.O.D.'s. We pay transportation charges. Ask your dealer.

FORMICA PANELS

We can furnish genuine formica panels 1/8" thick, cut to the following dimensions: 6x7; 6x10 1/8; 7x9; 6x14; 7x12; 6x21; 7x18; 9x14; 12x14; 14x18; 18x21. Price of panels—2 1/2c per square inch. For odd sizes order the next largest size: we will trim. We pay postage.

CROSLEY RHEOSTATS

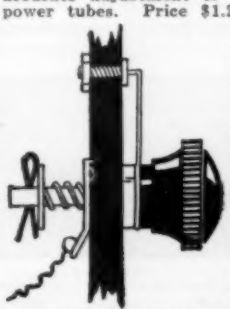


Complete with knob, pointers, etc. as shown in illustration. Our unique construction permits mounting on panel of any thickness up to and including 3/8": non-corrosive resistance wire.

Model "A"—overall diameter 1 5/8". Resistance 7 ohms, one ampere without heating. Suitable for detector or amplifier tubes. Price 60c each.

Model "B"—Resistance 4 ohms: will carry 3 amperes without heating. Suitable for detector, where very accurate adjustment is required and for 5 watt power tubes. Price $1.25.

CROSLEY TAP SWITCHES



Note unique construction assuring constant tension. Composition knob, nickel-plated switch arm and bushing. Note stationary washer with soldering lug, making possible buss wire connection. Price 40c each. Better—Costs Less.

SWITCH TAPS for above, brass nickel-plated, complete with brass nut 3c each, 30c per dozen or $2.50 per hundred.

If your dealer cannot furnish, we will ship direct prepaid.

CROSLEY MFG. CO.
Radio Dept. Q-6, Cincinnati, Ohio.

Whether You Say---

"The Darn Thing Won't Percolate"

or

"My Set Declines to Function Properly"

It Means the Same—

You Need WESRAD Service!

We Sell Apparatus — But We Give Service

Our Latest PRICE DICTIONARY Is Ready

Send For It—And Use It

"For Radio Only"

WESTERN RADIO ELECTRIC COMPANY

550 South Flower
LOS ANGELES, CALIF.

274 Twelfth St.
OAKLAND, CALIF.

AMATEURS, EXPERMENTERS, DEALERS

We beg to announce our appointment as distributors for
BALDWIN, BRANDES, MURDOCK, CLAPP-EASTHAM, CHELSEA, FIRTH, A B C, DEFOREST, MARSHALL-GERKEN and others

SPECIAL THIS MONTH

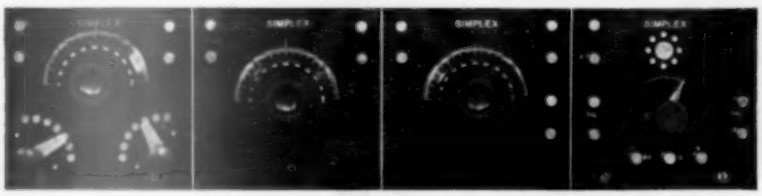
Bakelite Cut any size—⅛, 3/16, and ¼, 1½c, 2c and 2½c per square inch.
Mail Orders Promptly Filled.

Pittsburgh Radio and Appliance Co., Inc.

112 DIAMOND STREET, PITTSBURGH, PA.

"Pittsburgh's Radio Shop"

Exclusive 8th District Distributors for
"IDEAL" C W APPARATUS



Unmounted Variometers and Vario-Couplers $6.00 Each

Vario-Coupler	Variometer	Variometer	Audion Panel	Amplifier Panel
$10.00	$8.50	$8.50	$11.00	$20.00

These four panels form a short wave receiver of unusually high efficiency and appearance, fully described in bulletin #11. Write for it. If your dealer cannot supply you, send your order with his name.

Dealers send for trade discount.

SIMPLEX RADIO COMPANY, 1013-15 Ridge Ave., Philadelphia, Pa.

RADIO APPARATUS

Distributors of Reliable Radio Apparatus to Dealers, Schools, Colleges, Radio Clubs and Experimenters All Over the World!

"PITTSCO"

SERVICE DISTRIBUTES "RADIO CORPORATION'S" PRODUCTS ALL OVER THE WORLD! TRY US AND SEE!

"PITTSCO"

NOW HAS TWO STORES! BOTH CARRY "RADIO CORPORATION'S" COMPLETE LINE. ORDER TODAY FROM THE NEAREST!

RADIO CORPORATION'S PRODUCTS

No. UV-200 Radiotron, Detector	$5.00
No. UV-201 Radiotron Amplifier	6.50
No. UV-202 Radiotron 5 watt tube	8.00
No. UV-203 Radiotron 50 watt tube	30.00
No. UV-204 Radiotron 250 watt tube	110.00
No. UT-501 End-mountings for UV-204	2.50
No. UT-502 End-mountings for UV-204 Per Pair	2.50 4.50
No. UR-542 Porcelain Socket	1.00
No. UP-552 Bakelite Socket	1.50
No. UT-541 Porcelain Socket for UV-203 and UV-217 "Kenotron" tubes	2.50
No. UV-216 20 watt "Kenotron" tube	7.50
No. UV-217 150 watt "Kenotron" tube	26.50
No. UP-1368, 325 watt C.W. Transformer	25.00
No. UP-1016, 750 watt C.W. Transformer	38.50
No. UL-1008 Oscillation Transformer	11.00
No. UT-1343 Magnetic Modulator, ⅛, to 1⅛ amps.	9.50
No. UT-1357 Magnetic Modulator 1⅛ to 3⅛ amp.	12.50
No. UT-1367 Magnetic Modulator 3⅛ to 5 amps.	17.00
No. UP-1626 Filter Reactor, 160 Milli-amperes	11.50
No. UP-1627 Filter Reactor, 300 Milli-amperes	15.75
No. UP-415 Plate Circuit Reactor	5.75
No. UC-1631 Filter Cond. ¼ MFD 750 Volts	1.35
No. UC-1632 Filter Cond. 1 MFD 750 Volts	1.85
No. UC-1634 Filter Cond. ¼ MFD 1750 Volts	1.50
No. UC-1635 Filter Cond. 1 MFD 1750 Volts	2.00
No. UP-1719 Trans. Grid leak 5000 ohms	1.10
No. UP-1718 Trans. Grid Leak 5000 ohms for UV-203 and UV-204 Tubes	1.65
No. UM-530 Hot Wire meter, 0-2½ Amps.	6.00
No. UM-533 Hot Wire meter, 0-5 Amps.	6.25
No. UQ-809 Sending key for C.W. Transmission	3.00
No. UP-414 Microphone Transformer	7.25
No. PR-535 Filament Rheostat for UV-200, 201 and 202 tubes	3.00
No. PT-537 Filament Rheostat for UV-203 and UV-204 tubes	10.00
No. PX-1638 Rotary Grid Chopper	7.25
Shaft Bushings for ¼" or ⅜" motor shaft	.20
No. UC-1015 Antenna Series Condenser, 7500Volts .0003 .0004, .0005 MFD 3 values	5.40
No. UC-1014 Plate and Grid Condenser, 3000 Volts .002 MFD	2.00
No. UC-1803 Special Condenser, 10,000 Volts .000025 MFD.	5.00
No. UC-1806 Special Condenser, 6000 Volts, .002 MFD	7.00
No. UV-712 Amplifying Transformer	7.00
No. PR-536 "A" Battery Potentiometer	2.00
No. UC-567, .00025 MFD Grid and Plate Condenser	1.20
No. UC-568 .0005 MFD Grid and Plate Condenser	1.35
No. UC-569 .001 MFD Grid and Plate Condenser	1.50
No. UC-570 .0025 MFD Grid and Plate Condenser	2.00
No. UP-509 to UP-527 Grid Leaks .05 to 5 megohms, each	.75
No. UX-543 Grid leak mounting	.50
Note—Radio Corporations C.W. Instruction Book giving hookups, and complete information	.25

Announcement!!!

The policy of the F. D. PITTS CO. has been and will be to render a **"Superior Service"**, a Service based on carrying in stock for immediate delivery all desirable Radio apparatus, to serve our customers promptly and intelligently and to make them feel that we are truly grateful for their patronage.

In order to accommodate our ever increasing business we take pleasure in announcing the opening of OUR NEW STORE at PROVIDENCE, R. I. in the WOOLWORTH BLDG., at 193 Westminster Street, the very heart of the business section.

Mr. H. H. Tilley, a valued member of our organization will be in charge. His experience is wide and diversified, having in turn been an Amateur, Commercial Operator, Engineer, Instructor and Sales-Manager. You are cordially invited to visit our new store and experience real SERVICE.

If at any time you are interested in Radio to the extent of desiring instruction, Amateur or Commercial; Spark, Arc or Vacuum tube, let the EASTERN RADIO INSTITUTE train you—New England's, Oldest, Largest and Best equipped Radio School. For over six years I was Chief Instructing Engineer at this Institute, and I am in a position to know! Over 4000 satisfied graduates tell the story best! Our Organization with Years of phenomenal Results and Success is behind every man who enrolls.

F. D. PITTS
President and General Manager

"LET 'PITTSCO' PRODUCTS, SUPER-SERVICE, AND DELIVERY SOLVE YOUR HOLIDAY PROBLEMS"

SEND US YOUR ORDER TODAY!

Send ten cents for Catalog No. 22. Over 100 pages, over 150 illustrations, over 600 items.

F. D. PITTS CO., INC.

12 Park Square, Boston, Mass. **Branch—Woolworth Bldg. 193 Westminster St., Providence, R. I.**

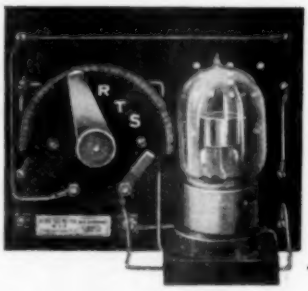
THE WONDERFULLY PERFECTED

RTS Standard Detector Panel

(Front)

Ten Points of Superiority

1—Silver Plated Wire
2—Machine Engraved Scale
3—Resistance, 8 Ohms
4—Small Wound Resistance
5—Grid Condenser and Leak accurate
6—Sure Contact Socket
7—Socket Used as a Standard
8—Decreased Resistance in Leads
9—Machined Letter Engraving
10—All Posts and Parts Perfectly Set



(Back)

5.95 Without Tube Prepaid by Insured Parcel Post.

RTS

Write today for circular giving full details.

Install this efficient R.T.S. Panel and you possess a correctly designed Detector Panel capable of producing signal strength unequalled by any other tested in our laboratory. It is guaranteed. Write for circular.

RADIO TESTING STATION

DEPT. 3 — 25 STUPGES ST., — BINGHAMTON, N. Y.

RADIO FREQUENCY TRANSFORMERS

Type RF-1 for amateur range $6.00

Mr. Amateur: Hook up a radio transformer ahead of your detector and get acquainted with stations you have not heard before.

The Type RF-1 is a:—

- **Transformer of special type R.F. iron core construction (Patent Pending.)**
- **Transformer having complete shielding.**
- **Transformer covering the amateur wave-length range efficiently.**
- **Transformer giving maximum amplification per stage.**
- **Transformer designed by former Government radio engineers.**

Commercial and special range R.F. transformers supplied.

RADIO SERVICE LABORATORIES

Incorporated

Asbury Park, New Jersey

The "QSA" Line of Radio Equipment

COMBAT

A storage battery of superior construction. The only battery with non-corroding terminals. Write for particulars and incidentally get on our mailing list to receive our special monthly bargain lists. December's list will contain a special offer on the "COMBAT". Don't risk missing this offer but write immediately for our descriptive circular.

6 VOLT 80 A. H. "COMBAT"

This month only at $21.00

Our catalog of "QSA" equipment sent for 10 cents

Independent Radio Supply Co.

3716 W. Douglas Blvd. Dept. H-12

CHICAGO, ILL.

"BETTER RESULTS WITH LESS EFFORT"

The Outstanding Specialties of the Season

Announcing FARADONS UC-1819 and UC-1831

FOR RADIO RECEIVING SETS

Model UC-1819

CAPACITY

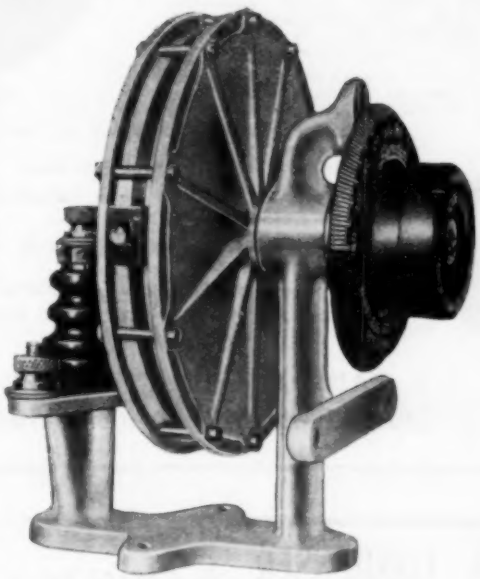
Minimum .0001 mfd.

Maximum .005 mfd.

PRICE, $8.75

These novel and unique condensers operate on an entirely new principle. They are less than 1/5 the size of air condensers of the same maximum capacity, and are suitable for back of board mounting as well as for open mounting.

The dielectric losses are extremely low—the power factor being less than 1/3 of 1%. There is no danger of warping plates as in the ordinary air condenser.



Overall Dimensions 4½x5½x4¾

FOR TUBE TRANSMISSION SETS

Model UC-1831

CAPACITY

Minimum .0001 mfd.

Maximum .0012 mfd.

PRICE, $9.00

FOR TRANSMISSION—Model UC-1831, which has the same appearance as UC-1819, was designed as a series antenna condenser for a C. W. tube transmitter. It will stand 5 amperes of CW at its maximum capacity setting and it will vary the radiated wave of the amateur set by 50 to 100 meters. By employing the C. W. circuits shown in the RCA catalog and inserting Condenser UC-1831 in the antenna circuit, the radiated wave length can be changed instantly and continuously by simply turning the drum. This is an ideal way to work through interference.

The close capacity variation of UC-1831 and its resultant fine tuning means more antenna current for the average station.

This condenser has been tested at 4000 volts maximum by the manufacturer.

FOR RECEPTION—Model UC-1819 provides a capacity small enough to act as a grid condenser and large enough for radio frequency circuits up to 30,000 meters. It has the unusually high ratio of maximum to minimum capacity of 50 to 1. It may be used as a primary or secondary tuning condenser or as a plate circuit by-pass condenser with equal effectiveness.

Permanent Calibration—
Unusual Capacity Range—
Rugged—Reliable

JOBBERS—DEALERS

These two condensers will soon find their way into practically every amateur station in the country. Be prepared for the demand. Orders accepted in rotation. Delivery begins February 1st.

Write Sales Division, Suite 1803

Radio Corporation of America

WORLD WIDE WIRELESS

233 BROADWAY ~ NEW YORK CITY

Anti-Capacity Dial and Knobs

The Copper Disc, moulded into the back of the Dial, with depressed track for grounded specially designed contact brush and stop, does the trick.

Eliminates All Hand Capacity Effects

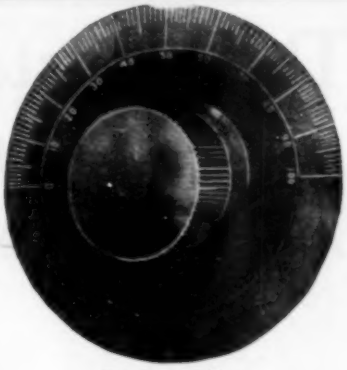
Dial and Tapered Knurled Knob moulded in one piece. Licensed under "Grebe" design patent 59,900.

Tapering of Knob allows fingers to release readily without disturbing fine adjustment.

Made of "Redmanol." The same phenol heat resisting moulded material as used by the U. S. Govt for its wireless aeroplane and trench sets.

A specially designed contact brush and stop, spring actuated phosphor bronze grounding contact, adjustable tension, is furnished with each Anti-Capacity Dial.

Dial and Knob are dull black finish to match panel. Will not warp or change its shape under any conditions.



Patent Pending

Patent Pending

Beautifully engraved with large brilliant white figures and scale, 3¼" diameter.

Projecting Moulded Shaft Hub on back makes dial turn true without friction.

Specify whether for $\frac{3}{16}$" or ¼" shaft.

Anti-capacity Dial and Knob including contact brush and holder $1.75.

Non-Anti-Capacity Dial and Knob same one piece design $1.25.

At your Dealers or sent direct on receipt of money order.

OUR FIRST SPECIALTY—OTHERS TO FOLLOW—
WATCH US GROW

RADIO EQUIPMENT & MFG. CO.

562 Atlantic Ave., Brooklyn, N. Y.

RADIO REMCO PRODUCTS

"EURACO" MICA CONDENSER

PRICE 60 CENTS

(.000025, .0001, .00025, .0005 MFD)
Designed to Fit Standard Grid Leak Base

Composed of Copper & Mica, Hand Made
Compact, Interchangeable, Most Efficient

Bakelite Base with Single Mounting..$0.40
Bakelite Base with Double Mounting.. .60
Bakelite Base with Triple Mounting.. .80

Interesting Proposition for Dealers

WE HANDLE ALL STANDARD APPARATUS
PROMPT SHIPMENT—ALL GOODS SENT POSTPAID

EUROPEAN RADIO CO.

Mfrs. of Multi-Stage Amplifiers, C.W. & Special Apparatus

1342 East 22 St., Brooklyn, N. Y.

Fifth District Amateurs

We have in stock—

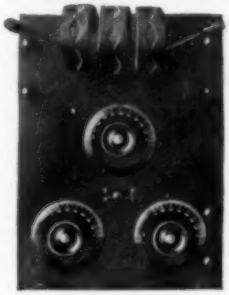
ACE B BATTERIES
ACME APPARATUS
CHELSEA CONDENSERS
CUNNINGHAM TUBES
BALDWIN PHONES
ELECTROSE INSULATORS
FORMICA PANELS
MAGNAVOX PRODUCTS
MURDOCK PHONES
REMLER PRODUCTS

Oklahoma Radio Shop

5XT P. O. Box 808 5XT
Oklahoma City, Okla.

Radiophone concerts daily
7:30 to 9 P.M.

Type "Q" Receiver



AN IDEAL RECEIVING SET FOR LONG AND SHORT WAVE AND RADIO TELEPHONE RECEPTION

This set is the most flexible receiving set on the market. With the use of the various sizes of Honeycomb Coils everything in the range of radio telegraph and telephone reception from 200 to 25,000 meters is brought into your home. Consists of a three coil mounting, and three Variable Condensers of proper capacity. Tuning extremely sharp. Remler dials.

Price without Detector.....$35.00

Duck's New Radio Catalog No. 16

Send 12c today for copy of the greatest radio catalog ever put between the pages of two covers.

275 Pages--A Catalog DeLuxe

Never in the history of radio was such a catalog printed. The radio data and diagrams embracing upwards of fifty pages, gives the experimenter more valuable and up-to-date information than will be found in many text books selling for $2.00, and $1.00 could be spent for a dozen different radio catalogs before you could gather together the comprehensive listing of worth while radio goods found in this great catalog.

A brief summary of the radio goods listed in this catalog:

The entire radio catalog of the Radio Corporation, with a wealth of scientific and technical data on C.W. transmitting sets, and all the diagrams for the assembling of these sets; the complete Remler catalog, which embraces 25 pages, the Westinghouse, Firth, Murdock, Federal, DeForest, Clapp-Eastham, Brandes, Connecticut Company, Thordarson, Turney, Magnavox Company catalogs, the best products of Adams-Morgan, Signal and countless other manufacturers, including our own complete line of radio apparatus, and many individual items and parts used in radio work today.

Send only 12c for copy of this wonderful catalog. You will need no other when you have Duck's, and you cannot find in all others combined what you will find in Duck's Wonder Catalog.

The William B. Duck Company

243-245 Superior Street **Toledo, Ohio**

COMBINATION OFFERS

—for RADIO CITIZENS

Parado Combination Offer No. 1 for a complete receiving set.

2 Remler Variometers with dial	$14.00
1 Remler Variocoupler, with dial	6.40
1 Switch and 10 Contact Points (nickel-plated)	1.00
2 Stops and 3 Indicators, (nickel-plate)	.25
1 Murdock No. 56 Headset	5.00
1 Burgess Battery, 22½ volts	2.25
1 Radiotron or Moorhead Tube	5.00
1 Murdock Rheostat	1.00
1 DeForest Socket	1.00
1 Panel 6x22x⅛	1.98
7 Nickel Plated Binding Posts	.70
12 Feet connecting wire	.10
1 Diagram of panel drillings and hook-up of instruments	FREE
Total	$38.68
OUR SPECIAL COMBINATION PRICE,	$34.80

Get our other Combination offers. Write for Free Price List and Bulletins on Parado Offers.

—for DEALERS and AGENTS

Get our Special Combination Offers to Dealers and Agents on apparatus made by these well known companies:

JEWELL, MOORHEAD, DEFOREST, BALDWIN, GREBE, BRANDES, MURDOCK, PACENT, ACME, FEDERAL, RADIO CORPORATION.

We represent the largest manufacturers of the best equipment made. If you are an agent or dealer get our special discount lists and bulletins.

Peoria Radio Sales Co.

Dept. A.

PEORIA

Illinois

KLAUS RADIO CO.

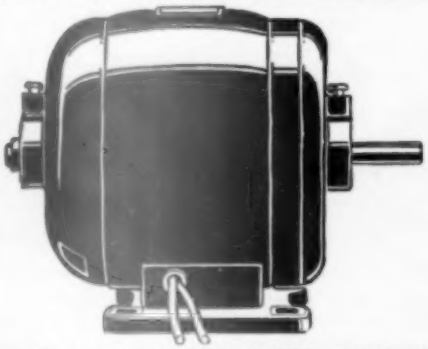
Dept 100.

EUREKA, ILL.

FIRST TESTED ~ THEN SOLD

F-F SYNCHRONOUS GAP BALL BEARINGED MOTOR

The MOTOR that has Made a Name for Itself. Distinguishes Your Station, by Getting Those Peaks that Put Snap into Your Transmission. Far Greater Efficiency with Less Strain on Condenser.



Here It is. The Complete MOTOR, Self-Excited, Ball-Bearinged for Continuous Service. Hook-Up Your Own Gap. Speed 1800 R.P.M. Shaft ⅜ Inch Diameter, Extends 4 Inches. Ready for Attaching any Make or Arrangement of Gap. ¼ H.P. Frame, 110 Volt, 60 Cycle, $34.00 f.o.b. Cleveland, Ohio. Shipping Weight 25 Pounds. Order from Your Dealer or Send Check for Prompt Express Shipment. If via Parcel Post have Remittance include Postage and Insurance charges. Or have us Ship C.O.D. Other voltages and frequencies at slight additional cost. Also larger sizes.

Order Now or Write Immediately for SYNCHRONOUS MOTOR Bulletin 318

The France Mfg. Co. OFFICES & WORKS CLEVELAND, OHIO, U.S.A.

Canadian Representatives: Battery Service & Sales Co. Hamilton, Ontario, Can.

4th DISTRICT! 5th DISTRICT! RADIO MEN!

LOOK AT THESE PRICES, CAN YOU BEAT THEM?

Switch contact points, Brass, Doz.	$ .25
Switch contact points, N. P., Doz.	.30
Binding Posts, Brass, Each	.07
Binding Posts, N. P. Each	.09
Remler Switch Levers 1"	.40
Fada Rheostat	1.00
Wilcox Rheostat	.65
Magnavox	45.00
Tuska Unassembled Reg. Tuner	27.50
Formica Panels cut to order, Sq. In.	.02
Our fully guaranteed "B" battery	
22½ volt 15 cell plain	1.50
22½ volt 30 cell plain	2.50
For variable add 25 cents	
45 volt 60 cell plain	5.00
New Clapp-Eastham regenerative tuner complete with detector control	35.00

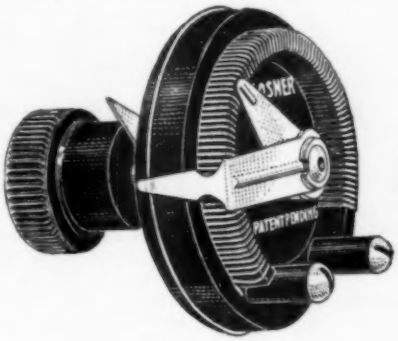
With each of these new HR sets we will give one B Battery free of charge.

We carry a complete line of the famous JEWELL Thermo-Couple instruments.

Our complete stock enables us to ship your order same day received. Estimates furnished free on any CW or phone installation. We have a blue-print for you of a good CW hookup which you may have for the asking. We carry a full stock of the following goods. Clapp-Eastham, General Radio, Remler, Cunningham, Magnavox, DeForest, Federal, Formica, Chelsea, Murdock, Amrad, Fireo, Tuska, RAC, Grebe, Acme, Esco, Ace, Turney, Shramco, Pacent, Radio Corp'n, FADA, Brandes, Baldwins, Willard "A" Batteries, American Radiograms and Postalgrams.

SOUTHERN RADIO SUPPLY CO.
Box 550, St. Petersburg, Fla.

KLOSNER

VERNIER  RHEOSTAT

For the modern critical tube

SIMPLE

QUICK

POSITIVE

MICROMETER RHEOSTAT WITH ONLY ONE KNOB!

See this new instrument at your dealer or send direct to us mentioning his name.

Price $1.50 F.O.B. New York

Sold on a satisfaction or money back guarantee.

DEALERS: Send immediately for our attractive proposition.

KLOSNER IMPROVED APPARATUS CO.

2404 CROTONA AVE., NEW YORK, N.Y.

ATTENTION! 4TH DISTRICT!

WE HAVE WHAT YOU NEED FOR THAT C-W AND PHONE SET

We have a complete line of Radio Apparatus for C-W Sets, Phone Sets, Spark Sets, Receiving. The following are a few items that we carry in stock. Write for catalogue.

FORMICA PANELS

6x9x 3/16	$1.00
6x12x 3/16	1.35
6x18x 3/16	2.00
9x12x 3/16	2.00
8x18x 1/4	2.75
12x18x 3/16	3.85
12x24x 1/4	5.35

RADIOTRON TUBES

UV-200 Detector	5.00
UV-201 Amplifier	6.50
UV-202 5 Watt Oscillator	8.00
UV-203 50 Watt Oscillator	30.00

HOYT METERS NICKEL PLATED FLUSH TYPE

H. W. A. 0-2½, 0-3 & 0-5 Amperes	6.50
0-15 V A.C. Volt Meter	8.00
0-200, 0-300, 0-500 & 1000 MA	10.00
0-600 V with Multiplier	17.25
0-1500 V with Multiplier	28.50

BALDWIN PHONES

Type C	12.00
Type E	13.00
Type F	14.00

CHELSEA RADIO

#4 Panel type condenser with dial	4.25
#3 Panel type condenser with dial	4.75
#41 Bakelite dial 0-100 scale	1.00
#42 Bakelite dial 0-50 scale	1.00

NEW APPARATUS

Federal Universal Plug	$1.75
Federal Hand Microphone	7.00
Acme 200 W C-W Transformer	16.00
Acme 500 W C-W Transformer	25.00
Acme 150W Filament Transformer	16.00
Thordarson 150 W Filament Transformer	10.00
Thordarson 300 W Filament Transformer	15.00
R.C.A. 325 W C-W Transformer	25.00
R.C.A. 750 W C-W Transformer	38.50
R.C.A. C-W Inductance	11.00
R.C.A. Grid Leak for 5W Tubes	1.10
R.C.A. Grid Leak for 50 W Tubes	1.65
R.C.A. Microphone Transformer	7.25
R.C.A. ½ Mf. 1750 W Filter Condensers	1.50
R.C.A. 1 Mf. 1750 W Filter Condensers	2.00
FADA Panel Rheostat	1.00
FADA Power Tube Rheostat	1.35
FADA Crystal Detector	2.25
Magnavox A-3 5 Watt New Type	45.00
Lightning Switch 100 Amp. 600 V.	4.00
Tuska C-W Inductance tapped every turn	4.65
Murdock #56—2000 Ohm Phones	5.00
Grebe CR-3 Special 150 to 1000 Meters	65.00
Grebe CR-8 same as above without Detector	80.00
Grebe CR-9 150 to 3000 meters	130.00
Grebe RORK two stage Amplifier	55.00
Grebe RORD Detector & two stage Amplifier	75.00
R.C.A. Series Condenser UC-1015	5.40
R.C.A. UC-1014 Condenser .002 mfd.	2.00

WE HAVE THE LARGEST STOCK OF RADIO APPARATUS SOUTH

Listen for our Phone 4XF—Sunday, Tuesday and Thursday Nights, 7:30 to 8:00 P. M.

QUALITY AND SERVICE OUR MOTTO — ORDERS SHIPPED SAME DAY RECEIVED

CARTER ELECTRIC COMPANY

63 Peachtree St., RADIO DEPARTMENT Atlanta, Georgia

MONEY SAVING SPECIALS

Audiotron Tube—two Filaments	$5.00
#55 Murdock 2000 Ohm Wireless Headset	4.00
#56 Murdock 2000 Ohm Wireless Headset	4.50
#55 Murdock 3000 Ohm Wireless Headset	5.00
#56 Murdock 3000 Ohm Wireless Headset	5.50
.0005 M. F. Grid Condensers	.25
.002 M. F. Phone Condensers	.25
Variable Grid Leaks ½ to 3 Megohms	.65
Radio Service V.T. Sockets	.75
Paragon V.T. Sockets	.90
Binding Posts Rubber Cap, per Doz.	.75
Fada Rheostats	.90
Chelsea Dial & Knob	.90
Cyclone 22½ Volt Small B. Battery	.90
Cyclone 22½ Volt Large B. Battery	1.60
Cyclone 45 Volt Variable B. Battery	2.75
Eveready 22½ Volt Large Variable B Battery	2.50
Murdock .0005 Unmounted Variable Condnsers	3.00
Murdock .001 Unmounted Variable Condensers	3.75
4 Volt 40 Amp. Marko Storage Battery	7.00
6 Volt 40 Amp. Marko Storage Battery	10.50
6 Volt 60 Amp. Marko Storage Battery	14.00
6 Volt 80 Amp. Marko Storage Battery	18.00

Above Batteries are fully Charged when shipped

We do not charge for crating.

The above prices are F.O.B. New York

Hygrade Electrical Novelty Co.

41 West 125th Street, New York

—FREE—

One Complete Microphone

GIVEN TO THE FIRST 100 MAIL ORDER PURCHASERS sending us an order for $3.00 or more.

To advertise our RADIO SERVICE we are GIVING AWAY 100 MICROPHONES.

These are used instruments which have been carefully tested and are guaranteed to be in first class working condition.

We purchased these high grade microphones taken from telephone instruments recently retired by a large telephone system. After testing them in our C.W. Telephone Sets we found them to meet the requirements better than the average new $3.50 to $5.00 Microphone.

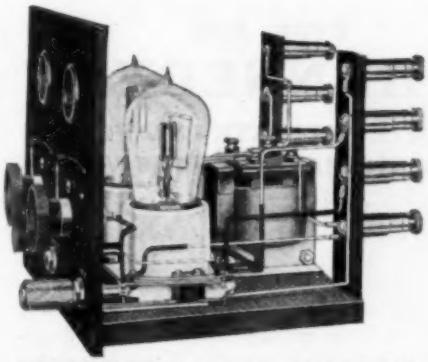
Be one of the Lucky 100 and make out your order at once. Below is a list of some of the Standard Radio Supplies carried in stock.

Westinghouse	Magnavox
Grebe	Hopewell
Radio Corp.	Acme
Murdock	Jewell
DeForest	Amrad
Tuska	Federal
Remler	Clapp-Eastham
Signal	Formica

PIONEER ELECTRIC CO.

137 E. 5th St., St. Paul, Minn.

TELMACO



Vacuum Tube Detectors and Amplifiers

The Very Best That Skill and Experience Can Produce

Telmaco's policy is to give better values. That is why we are forced to work overtime to fill orders. Last month we were compelled to make slight delays in shipments in a few instances. This we very much regret. We have now increased our facilities so that **everybody will receive his Telmaco Apparatus promptly.**

THE CABINETS are constructed of selected quarter sawed oak; stained inside and out; waxed and hand rubbed. **PANELS** are of grade M $\frac{1}{4}$ in. Formica, 6½ in. high; grained finish. They are attached to draw shelf, permitting complete assembly to be instantly removed and used without cabinet, if desired. **FILAMENT CONTROL RHEOSTATS** are of approved type.

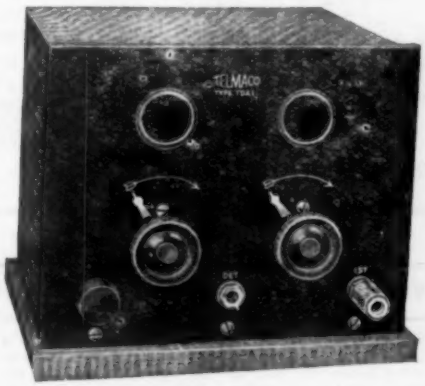
TELMACO SPECIAL BINDING POST CONSTRUCTION is used throughout, entirely eliminating all wiring from the front of the panel. **AMPLIFYING TRANSFORMERS** are of new type, designed to operate with maximum efficiency with the new type tubes. We furnish them **FULLY MOUNTED.**

The **GRID CONDENSER** and **VARIABLE LEAK** are wired in the detector circuit, the latter on the front panel. **SOCKETS** are of high grade construction to fit tubes having standard four prong bases. **LETTERING** on panel is pantograph machine engraved and filled with best grade of white enamel.

FULL AUTOMATIC CONTROL JACKS are wired into these amplifiers. **RADIO PLUG** is furnished with the above.

TELMACO VARIOMETERS and VARIO-COUPLERS

VARIOMETER—Price without dial	$5.00
With Remler Dial—Price	6.00
VARIO-COUPLER—Price without dial	4.00
With Remler Dial—Price	5.00



PRICES

Type TD-1 Telmaco Vacuum Tube Detector Unit	$15.00
Type TDA-1 Telmaco Detector and Single Stage Amplifier Unit	35.00
Type TA-2 Telmaco Two-Stage Amplifier	40.00
Type TDA-2 Telmaco Detector and Two-Stage Amplifiers	45.00

ORDER DIRECT FROM THIS AD.

Satisfaction guaranteed always or money refunded. Send for our complete catalogue "T". You'll find it interesting.

Your panels engraved with our **GORTON ENGRAVER.** Price 5 cents per letter. Minimum charge $2.00.

DEALERS! We are distributors for nearly all Standard Lines. Write for our Special Proposition.

RADIO DIVISION

Telephone Maintenance Co.

17 N. LaSalle St., Chicago, Ill.

KENNEDY EQUIPMENT

TYPE 220

KENNEDY

INTERMEDIATE - WAVE REGENERATIVE RECEIVER

Licensed under Armstrong U.S. Patent No. 1,113,149

The immense demand for this receiver that has developed since its recent announcement confirms our belief that it offers more in *concentrated quality value* than any other on the American market. Its range of 175 to 3100 meters makes it very desirable for the man who wants more than a short-wave set offers but who is not interested in long-wave reception.

If *your* dealer does not yet carry Kennedy Equipment, send us his name and we will mail you Bulletin 201 describing this unit.

THE COLIN B. KENNEDY COMPANY
INCORPORATED

RIALTO BUILDING SAN FRANCISCO

The "QSA" Line of Radio Equipment

SERVICE?—Pshaw! We could fill a page talking about it. We have, of course, the utmost confidence in our ability to live up to any promises we might make. But, since you are the judge, all we ask is an opportunity to demonstrate our ability to give you the kind of service you want. We list below, for your convenience, a representative group of radio supplies. Most of the items are just what you need to put your set in shape for real DX work. Well then, send your order in at once and give us the chance to prove ourselves. We will appreciate it.

Radiotron U.V.200 detector	$5.00
Radiotron U.V.201 Amplifier	6.50
Radiotron U.V.202 5 watt transmitter	8.00
U.V.712 Intertube Transformer	7.00
*Fada detector comp. with crystal	2.25
Acme 1K.W. Spark Transformer	28.00
Acme Amplifying Transformer	5.00
Brandes Navy Type Phones	14.00
*FADA Panel Mounting Rheostat	1.00
PR-536 "A" Battery Potentiometer	2.00
45V. B Battery special at	1.85

*These are listed at the new reduced price. Of course we handle many more items than listed here, but that is why we have a

CATALOG

Sent for 10 cents which amount will be refunded on initial purchase amounting to $1.00. Send for it TODAY.

Independent Radio Supply Co.
3716 W. Douglas Blvd. Dept. H-12
CHICAGO, ILL.
"BETTER RESULTS WITH LESS EFFORT"

THERMO-COUPLE INSTRUMENTS FOR C-W

All long distance C.W. operators use thermo-couple ammeters.

Precise electrical measurements are the basis for the successful operation of any C.W. set.

Unreliable and inaccurate instruments will result in the unreliable operation of any set.

Government Bureau of Standards tests have shown Jewell thermo-couple instruments to be accurate and reliable.

PRICE $12.00

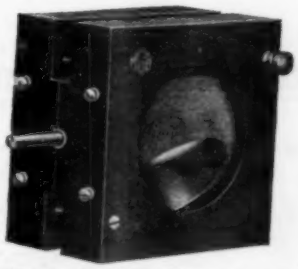
ORDER FROM YOUR DEALER

Jewell Electrical Instrument Co.
CHICAGO

New Moulded Variometer

WITH POSITIVE PIGTAIL CONNECTIONS

Price **$6.50**



TYPE M.V.G.
FOR GRID

TYPE M.V.P.
FOR PLATE

True to the thousandth of an inch. Its correct weight renders screws unnecessary for table operation—four screws are supplied for panel mounting. These instruments are in keeping with Marshall-Gerken high standard of quality.

New "Read 'Em" Binding Posts

15 STYLES—ENGRAVED—NOT STAMPED

Antenna
Ground
Condenser
Variable Condenser
Tickler
A—Battery+
A—Battery–

B—Battery+
B—Battery–
Plate
Detector
Phones
Secondary
Primary

Grid

Complete Post and Knob 25c each

Distributors for

Westinghouse
Remler
Cunningham

Pacent
Signal
Murdock
Radio Corporation of America

Jewell Meters
Weston Meters
Cooper Battery

The Marshall-Gerken Co.

MANUFACTURERS & JOBBERS

TOLEDO, OHIO

PATTERNS

Something New In Radio

In building a Radio apparatus the lack of mechanical knowledge often handicaps the amateur in such a way that the instrument he builds has not the standard made appearance which is desirable in any Radio apparatus. In order to remedy this, and give the amateur a chance to turn out an efficient and handsome looking instrument, we have designed a special set of patterns enabling anyone to make a standard receiver with all the improvements that can be found in expensive ready-made apparatus.

One of the foremost Radio engineers has constructed this set for us, specially for the amateur, and by our modern, novel methods of construction, anyone is able to make an efficient apparatus for the reception of wave-lengths up to 800 meters.

Complete and very explicit directions go with the pattern which is furnished in a heavy envelope 9x12".

The set consists of two blue prints, size each 19x21 inches and a four page 9x12 in. direction-pamphlet.

No. 1. Complete pattern for short wave regenerative set each prepaid **50c.**

Complete short wave regenerative set.

FOR SALE IN ALL GOOD RADIO STORES

If your dealer cannot supply you, send your order to us.

Consolidated Radio Call Book Co., Inc., 98 Park Place, New York City

---

OF COURSE

You want your goods shipped promptly and postpaid. Save both time and money by ordering directly from this ad.

Q1-A new Short-Wave Regenerative Set unwired, Formica panel, excellent finish, range 150 to 600 meters	$28.00
Q2—Radiotron 200, detector	5.00
Q3—Radiotron 201, amplifier	6.50
Q4—Radiotron 202, transmitter	8.00
Q5—Murdock Moulded V-T Socket	1.00
Q6—Crosley Porcelain V-T Socket	.60
Q7—Power Tube Rheostat, 5 ampere	1.85
Q8—Firco Amplifying Transformer	5.00
Q9—Murdock 43 plate Variable Condenser	4.50
Q10—Amrad Variometer (honeycomb)	6.10
Q11—Amrad Variocoupler (honeycomb)	6.90
Q12—Anti-Capacity Switch	2.50
Q13—Murdock 256 Phones	6.00
Q14—Baldwin Amplifying Phones	13.75
Q15—Large Burgess "B" Battery, 22½ volt	2.25
Q16—Burgess "Baby B" Battery, 4½ volt	.40
Q17—Laminated Nickel Switch Lever	.65
Q18—Large Nickel Switch Points	.04
Q19—Large Nickel Binding Posts	.11
Q20—Cabinet 6"x14", Flemish Finish	3.30
Q21—Formica Panel for same	2.10

Our new Radio Catalog describes Radio Telephones from 10 watts to 2 K. W. $45 to $4000; Spark Transmitters; Receiving Equipment; Antenna Materials; and the best line of Parts ever offered. It will be sent free with any order of $1.00 or more from this advertisement; or mailed to any other address on receipt of 25 cents in stamps, which will be refunded on the first order for $1.00.

CRAIG AND LOUGHBOROUGH

Norwood Nat. Bank Bldg., Norwood (Cincinnati) Ohio.

BUY YOUR

Radiograms
Relay Radiograms
Radio Postgrams

Direct from the Printers' and save money!

100 Radiograms (1 pad)	$0.20
100 Relay Radiograms (1 pad)	.25
100 Radio Postgrams, printed on Government Post Cards	1.75

Carrying charges prepaid when cash accompanies order. No order for less than $1.00 accepted.

You'll like our design, and we guarantee the quality. Order a supply today upon condition that we refund your money if you are not delighted.

PENN PRINT SHOP

Box 110-R, Reading, Pa.

DESIGN CONSTRUCTION REPAIR

Service for the Amateur

Beginning January first 1922 a test curve will be furnished free of charge with every UV200 and 201 Radiotron Tube purchased from us.

New England Radio Engineering Co.

380 LaGrange St., Boston 32, Mass.

THE RADIOLECTRIC SHOP COMPANY

919 HURON RD., CLEVELAND, OHIO

RADIO 73 PRODUCTS

EVERY ARTICLE LISTED READY FOR IMMEDIATE DELIVERY UPON RECEIPT OF YOUR ORDER

"73" AERIAL EQUIPMENT.

"73" Antenna Cable, 7 Strand #22 per 100 ft. $0.65. Add 10c per 100 for Postage.

"73" Antenna wire #14 hard drawn copper per 100 ft.	$0.45
"73" Ball type Insulators (for receiving)	.40
"73" 4 inch Insulators (for receiving)	.45
"73" 10 inch Insulators (for sending and receiving)	.90
"73" Lead-in Insulators	.50
"73" Lightning Switch 100 Amp. 600V.	7.00

Our Insulators do not pull out or turn white.

AMPLIFYING TRANSFORMERS

UV712 Radio Corporation, latest model	$7.00
Federal, Model 226W	7.00
General Radio #231A for Radiotrons	5.00
Acme Type A-2 semi mounted	5.00
J-K	4.50
Rhamstine	3.50

"B" BATTERIES

"Victory" 13V. Storage 2 year guarantee	3.75
"Victory" 25V. Storage 2 year guarantee	7.50
"Victory" 50V. Storage 2 year guarantee	15.00
"Victory" Rectifier for charging	3.00
"American" #5763 small	2.25
"American" #5766 tapped	3.00

AMPLIFIERS

"Wimco" 2 stage Iron shielded	50.00
"Wimco" Detector and two stage Iron Shielded	70.00
"Wimco" Detector Control Iron Shielded	22.50

LOUD SPEAKERS

Vocaloud Station Type	30.00
Type R Magnavox	45.00

PLUGS

Firco Bull Dog Grip	2.00
Federal #15 takes tips, wire, spades, tinsel	1.75
Federal #1428	2.00

VARIOMETERS

"73" Variometers, complete	$5.00
Parts "73" Variometers	2.50
Tuska Variometers	6.25
R mler Variometers	6.00

KNOBS AND DIALS

Tuska, flush type 4"	1.65
Chelsea,, Molded Bakelite 3¼"	1.00
Amrad, 90 and 180 degrees	.80
"73" Navy Type, Nickeled, 4"	1.25

Specify size shaft on order

SOCKETS

Chelsea	$1.00
General Radio	1.50
Paragon	1.00
Murdock	1.00
Crosley Porcelain	.60
J-K Porcelain	.80

METERS

Hickok Dynamometer type for A.C. or D.C.	10.50
Milliammeters any readings up to 500 MA	10.50
Voltmeters any readings up to 1000 Volts	10.50
Ammeters any readings up to 25 Amperes	10.50
Thermo Radiation Meters readings up to 15 amperes	15.00

These instruments in moulded Condensite cases for flush mountings.

TRANSFORMERS AND RECTIFIERS

Acme 50 watt unmounted	12.00
Acme 50 watt mounted	15.00
Acme 200 watt unmounted	16.00
Acme 200 watt mounted	20.00
Tuska 100 watt mounted	16.50
F-F Bantam Battery Booster	15.00

PHONES

Murdock 55's 2000 Ohms	4.50
Murdock 56's 2000 Ohms	5.00
Murdock 55's 3000 Ohms	5.50
Murdock 56's 3000 Ohms	6.50
Federal 2200 Ohms	8.00
Federal 3200 Ohms	10.50
Baldwin Type C 2000 Ohms	13.75
Baldwin Type E 2000 Ohms	15.00
Baldwin Type F 2000 Ohms	16.25
Baldwin Type G Latest improved type	17.50
Brown Type A 4000 Ohms	18.00
Brown Type B 8000 Ohms	20.00

INDUCTANCES

Tuska Moulded, tapped every turn	4.65
Tuska Moulded, tapped every third turn	4.15
Wimco 25 Turn edgewise wound for 50 watt tubes	10.00
Wimco 50 Turns	13.50
Tuska Moulded tube for inductance (threaded)	3.15

"73" PUNCTURE PROOF C.W. CONDENSERS

1 MF 1500 Volts	4.00
2 MF 1500 Volts	5.00
5 MF 1500 Volts	10.00
2 MF 2500 Volts	15.00
2 MF 4000 Volts	23.00
5 MF 2500 Volts	30.00
"73" Variable Grid Condenser	.65

Detector Tubes $5.00, Amplifier Tubes $6.50, 5 Watt Power Tubes $8.00

ORDER NOW—DO NOT DELAY

Our catalog now ready. Is your name on our mailing list? A card will do it.

The Radiolectric Shop Company

919 HURON RD., CLEVELAND, OHIO

ORDER VIA RADIO 8BBW

THE LATEST A-A 10 to 1 RATIO
AUDIO FREQUENCY AMPLIFYING TRANSFORMERS

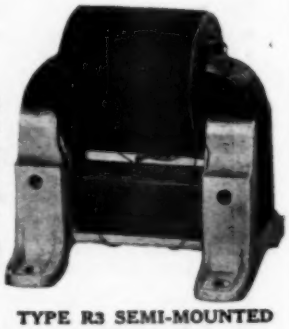
TYPE R3

With the introduction of the new UV-201 and C-301 Cunningham amplifying tubes we found it necessary to design an Audio Frequency Amplifying Transformer that would meet amplification and internal resistance constants which are quite different from those of the previous tubes. "A-A" amplifying transformers are scientifically designed for commercial manufacture and are made strictly on a quality basis. They are most efficient because the turn ratio and resistance of the windings are such that maximum amplification is obtained without distortion in the telephonic currents. The coils are wound with #40 enameled wire with treated paper insulation between the layers of winding and the convolutions of wire are spaced to cut the turn to turn capacity down to the minimum. This is a big factor in eliminating distortion—commonly known as howling. All of our transformers are impregnated in a special wax compound by the vacuum process.

MOUNTED $4.50 UNMOUNTED $3.50 SEMI-MTD. $4.00

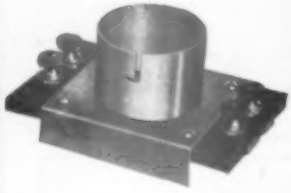
Our first transformer having a ratio of 3 to 1 has proved to be most efficient on Marconi VT's, Moorhead, Western Electric and similar tubes and will also be found desirable on the 3rd or 4th step using the UV201 tubes with our new transformer on the 1st and 2nd stage. It is known as AA Type R2.

MOUNTED $4.25 UNMOUNTED $3.35 SEMI-MTD. $3.80



TYPE R3 SEMI-MOUNTED

The "A-A" Power Tube Socket



This socket is designed for use with the UV 203 and the C 303 50 watt power tube. A well made, nice appearing socket, with insulation designed to withstand 3000 volts. Socket and base shell are of brass with Bakelite strips containing binding post terminals. Shipping weight, 2 pounds.

No. R-4 Power Tube Socket, price.....$3.00

ALL-AMERICAN ELECTRICAL MFRS.
1516 N. Lorel Ave., Chicago, Ill.

WIRELESS CATALOGUE

Whether you are interested in a complete radio receiving outfit, or a half a dozen binding posts, you'll find the particular instrument, best for your needs, in Corwin's catalogue. Send 10 cents, (*credited to your first order*) *for your copy today!* Where's the nearest mailbox?

A.H.CORWIN&CO.
4 West Park St. Dept. 00.
Newark New Jersey

Radio Amateurs of
COLORADO, UTAH, WYOMING, NEW MEXICO and NEBRASKA
Please Remember

DENVER

HAS THE LARGEST WIRELESS SUPPLY STORE in MIDDLE WEST
Everything in Radio Supplies.

We Are Distributors of
REMLER, COLIN B. KENNEDY CO.,
DEFOREST RADIO and W. J. MURDOCK
EQUIPMENT and PARTS

WE MAKE IMMEDIATE DELIVERY

Write for our Bulletins and Price List. We will give prompt Mail Order Service by Parcel Post or Express, as requested. Our "REYNRAD" Short-wave Coils are best on the market—$2 each.

REYNOLDS RADIO CO., Inc.
613 19th St., DENVER, COL.

Radio Storage Batteries

6 volt 40-60 amp.....$10.00
6 volt 60-80 amp..... 12.00

All Brand New and Guaranteed

W. & G. TUFTS
336 Newbury St., Boston, Mass.

RECEIVE ON A COIL AERIAL
ELIMINATE THAT QRM

Complete set of curves and tables giving wave length ranges of coils of various numbers of turns with different tuning capacities. 50c per copy.

C. A. DAVIS & CO.
2371 Champlain St., N. W., Washington, D. C.

DO YOU KNOW?

THAT YOU CAN SAVE MONEY
YOU CAN GET REAL SERVICE
YOU CAN SAVE MUCH TIME

BY

SEND FOR THE RADIO CORPORATION Book of CW INSTRUCTION $0.25

SENDING YOUR ORDER TO "MISSOURI"

VACUUM TUBES

No. UV200 Radiotrons detector $5.00
No. UV201 Radiotron Amplifier 6.50
No. UV202 Radiotron 5 watt 8.00
No. UV203 Radiotron 50 watt 30.00
No. AP Amplifier oscillator 6.50

B BATTERIES

No. 766 Eveready 22½ volt variable .. 3.00
No. 774 Eveready 43 volt variable..... 4.50
No. 765 Eveready 22½ volt .2.00

REGENERATIVE RECEIVERS

No. CR-3 Grebe Relay-special 175-680 meters 65.00
No. CR-5 Grebe super-special 175-3000 meters with detector complete 80.00
No. CR-8 Grebe 175-1000 meters with detector latest type short wave set ...80.00
No. CR-9 Grebe 175-3000 meters complete with det. & 2 stage amplifier..... 130.00
No. CR-6 Grebe 175-680 meters with det. and 2 stage amp. phone & series cond... 160.00
No. RA Westinghouse 170-700 meters ...65.00

PLUGS

No. 50 Pacent universal type..... 2.00
No. 34a Firco flat type 2.00
No. 35b Firco Round type 2.50
No. 1428-W Federal brass 2.00

JACKS

No. 1422-W Federal closed circuit..... .85
No. 1423-W Federal two circuit..... 1.00
No. 1435-W Federal automatic control... 1.20
No. 1438-W Federal automatic control... 1.50

RECEIVING SETS (Crystal)

Westinghouse "Aeriola" with phones.....25.00
DeForest crystal receiver 25.00

TELEPHONES

No. 56 Murdock 2000 ohm..... 5.00
No. 56 Murdock 3000 ohm 6.00
No. C Baldwins 12.00
No. E Baldwins 13.00
No. F Baldwins 14.00
No. G Baldwins new style static-proof..15.00
No. C Baldwins single unit only 6.00
No. Brandes "Superior" type 8.00
No. Brandes "Transatlantic" type 12.00
No. Brandes "Navy" type 14.00

BOOKS

Practical Wireless Tel. by Bucher..... 2.25
Wireless Experimenters Manual by Bucher 2.25
How to pass US Govt. exams by Bucher .75
How to conduct a radio club by Bucher .75
Practical amateur stations by Bucher.... .75
Radio Corporations CW Instruction..... .25

VARIOMETERS

No. 500 Remler moulded $6.00
No. 501 Remler with dial & knob..... 7.00
No. 1 Tuska moulded type 6.25
No. 2 Tuska with dial moulded 7.50
No. ZRV Clapp-Eastham with dial 6 50
No. Amrad with knob & dial 6.10

VARIO-COUPLERS

No. 503 Remler moulded type 5.40
No. 2163 Amrad with dial 6.90
No. 3 Tuska moulded with dial 8.50
No. ZRV Clapp-Eastham with dial 7.50

AMPLIFIERS

No. RORK Grebe 2 stage 55.00
No. RORD Grebe det. & 2 stage 75.00
No. 333 Remler 1 stage 9.00
No. DA Westinghouse det. & 2 stage ...65.00

LOOSE COUPLERS

No. 344 Murdock 1500 meters 9.00
No. F-673 Clapp-Eastham 3000 meters ...14.00

LOUD SPEAKERS

No. R-3 Magnavox new model 45.00
No. Vocaloud station type 30.00
No. 400-W Federal "Pleiophone" 14.00

CONDENSERS (variable)

No. 1500 Wireless Shop .0004 mfd. 6.00
No. 2500 Wireless Shop .0006 mfd. 7.50
No. 3500 Wireless Shop .0008 mfd. 9.00
No. CV-500 DeForest .0005 mfd. 4.75
No. CV-500 DeForest Knockdown .0005 mfd. 3.00
No. 3660 Murdock mounted .001 mfd. ... 4.00
No. 367 Murdock mounted .0005 mfd. ... 3.75

CONDENSERS (fixed mica)

No. 577 Dubilier all capacities 2.00
No. UC1014 Radio Corp. .002 mfd. 2.00
No. UC1015 Radio Corp. .0003, .0004, .0005, 7500 volts 5.40
No. ROCC Grebe .0002 mfd. 1000 volts.. 1.00
No. ROCD Grebe .0005 mfd. 1000 volts.. 1.20
No. ROCF Grebe .005 mfd. 1000 volts.. 3.80

COILS (duo-lateral)

DL-25	$1.40	DL-300	$1.75
DL-35	1.40	DL-400	1.80
DL-50	1.45	DL-500	2.00
DL-75	1.50	DL-600	2.15
DL-100	1.55	DL-750	2.30
DL-150	1.60	DL-1000	2.55
DL-200	1.65	DL-1250	3.00
DL-250	1.70	DL-1500	3.45

COIL MOUNTINGS

No. 400 Remler 3 coil mounting..... 6.50
No. ULC-100 DeForest 3 coil with gears 8.50

WE HAVE ALL STANDARD MAKES OF APPARATUS OR PARTS AT REGULAR LIST PRICES

LET "MISSOURI" SERVICE REACH YOU

SEND US YOUR ORDERS NOW!

MISSOURI RADIO SUPPLY COMPANY

4623 MARYLAND AVE., DEPT F-1 ST. LOUIS, U. S. A.

PLEASE INCLUDE SUFFICIENT POSTAGE WITH ALL MAIL ORDERS

J-RAY

Variometers and Variocouplers

in knockdown form enable you to make a large saving in the cost of your receiving set. Forms 4¾" square, 1¼" wide, of beautiful non-shrinking mahogany, guaranteed to be the prettiest variometer and the best value on the market.

Order a set today and be convinced. Money back if not satisfied.

Variometer, complete parts, as shown, unwound, $2.00; wound, $3.80; Variocoupler ball, as shown, unwound, $0.75; wound, $1.10; Formica primary tube, wound, 7 taps, $1.20; unwound, $0.40. Complete vario set, 2 Variometers and 1 Coupler, wound ready to assemble, $9.75.

All holes drilled, bearings, directions, etc., furnished.

Let us supply your Radio wants from our complete line of apparatus Acme, Radio Corp., Grebe, Murdock, General Radio, Jewell, Clapp-Eastham, Baldwin and all leading makes of apparatus available for immediate shipment.

J-RAY MFG. CO.

2131 DE KALB ST., ST. LOUIS, MO.

New Catalog E6 Just off the press FREE

24-Hour Service

We pay all Shipping Charges

Get the latest

Don't buy till you see this catalog.

Keep up-to-date. Learn about all the big recent improvements in radio apparatus.

84 pages chuck full of best and biggest values of America's 51 leading manufacturers. Most complete, includes everything.

Two N-S LEADERS

Red-Head Radio phones, 3000 ohms, military head band with cord complete Per pair **$8.00**

Arlington Tested Crystals; Galena or Silicon. Certified supersensitive Per crystal **25c.**

Write for Big Free Catalog Today

THE NEWMAN-STERN CO.

Newman--Stern Bldg., Cleveland, Ohio

Wireless Amateurs Attention!

If you want service, order from us. We carry a large stock of High Grade Wireless Apparatus of our own and other manufacturers.

SPECIAL!

Vacuum Tube Sockets	**$1.25**
Rheostats	**1.25**
22½ Volt "B" Batteries	**1.50**
Rasco Dials	**.60**
Rubber Binding Posts	**.20**
Tested Galena	**.40**

Lateral Wound Coils. All Sizes.

Send 5c for our large illustrated catalog.

J. M. PAQUIN,

THE ELECTRICAL SHOP,

787 Queen St. West, Toronto, Ont.

THE FAMOUS Vocaloud, "Bull-dog Grip" interchangeable Telephone Plugs, Saco-Clad transformers, Vocatone apparatus and other Firco products are for sale by all leading dealers.

JOHN FIRTH & CO.

18 Broadway, New York

Telephone and Musical Concerts

If you want to hear them, get our simple diagram and hook up advertised this issue under classified advertisements.

VIRGINIA NOVELTY COMPANY

Martinsburg, West Va.

MEYBERG

The Largest Radio Stock on the Pacific Coast

SAN FRANCISCO

Everything the Amateur Wants

LOS ANGELES

Send for 32-page Remler Catalogue—just off press

Stocks Guaranteed—Prompt Service From Either Address

VACUUM TUBES

C300 Cunningham Detector	$ 5.00
C301 Cunningham Amplifier	6.50
C302 Cunningham 5 Watt Power	8.00
C303 Cunningham 50 Watt Power	30.00
UV200 Radiotron Detector	5.00
UC201 Radiotron Amplifier	6.50
UV202 Radiotron 5 Watt Power	8.00
UC203 Radiotron 50 Watt Power	30.00
Moorhead Electron Relay	5.00
Moorhead VT Amplifier	6.50
Moorhead VT Transmitter	7.50
Moorhead Rectifier Tube	9.75

All tubes postage postpaid.

AMPLIFYING TRANSFORMERS

231A General Radio	$ 5.00
226W Federal	7.00
A2 Acme-Unmounted	4.50
A2 Acme Semi-mounted	5.00
A2 Acme Fully mounted	7.00
UV712 Radiotron	7.00

EVEREADY BATTERIES

765 Small 22½ Volt B	$ 2.50
766 Large 22½ Volt B	3.50
774 Variable 43 Volt B	5.00
746 Special 108 Volt Amp. B	16.50
6 Volt 40 Amp. hr. Storage	18.20
6 Volt 60 Amp. hr. Storage	20.80
6 Volt 80 Amp. hr. Storage	24.05

REMLER APPARATUS

Moulded Bakelite Variometers	$ 6.00
503 Moulded Bakelite Variocouplers	5.40
100 3" Bakelite Dial and Knob	1.00
330 Detector Panel Moulded Bakelite	8.00
331 Amplifier Panel less Transformer	6.00
333 Amplifier Panel less Transformer (with cam switch)	9.00
810 Jr. Reostat	1.00
94 A Battery Potentiometer Unit	.75
74 Knob and Lever for above	.45
96 Variable Grid Leak	.60
97 Fixed Grid Condenser	.35
400 3 Coil Mounting on base	6.50
3 Coil Mountings for Panel Mtg.	3.60

TELEPHONES

Brandes Superior	$ 8.00
Brandes Trans-Atlantic	12.00
Brandes Navy	14.00
Baldwin Type C Navy	16.50
Baldwin Type E	20.00
Baldwin Type F	21.00
Murdock No. 55 2000 ohm.	4.50
Murdock No. 55 3000 ohm.	5.50

JACKS AND PLUGS

Federal 1421 open Circuit Jack	$ .70
Federal 1422 single Circuit Jack	.85
Federal 1423 double Circuit Jack	1.00
Federal 1435 Automatic Filament Control Jack	1.20
Federal 1438 Automatic Filament Control Jack	1.55
Western Electric Plugs	1.30
Federal Plugs	2.00
Pacent Universal	2.00

SOCKETS

No. 92 Remler Socket	$ 1.50
No. 156 General Radio	1.50
No. 550 Murdock	1.00
No. R300 DeForest	1.60
De Forest Moulded Bakelite	1.40

VARIABLE CONDENSERS

No. 230 Wireless Shop Panel Mtg. .0005	$ 3.00
No. 430 Wireless Shop Panel Mtg. .001	5.25
No. 630 Wireless Shop Panel Mtg. .0015	7.50
No. 1 Chelsea Mtd. .0011	5.00
No. 2 Chelsea Mtd. .0006	4.00
No. 3 Chelsea Unmtd. .0011	4.50
No. 4 Chelsea Unmtd. .0006	4.00

REGENERATIVE RECEIVERS

Myco D12 175 to 25000 meters Detecter 2-step Amp. less Coils and Tubes	$165.00
CR3 Grebe Relay Special	68.00
CR3A Grebe Tube Control self-contained	47.50
CR5 Grebe 175-3000 meters tube control	85.00
CR6 Grebe 175-680 meters Det. 2-step	210.00
CR7 Grebe 5000-20000 Long wave Special	230.00

C. W. APPARATUS
JEWELL METERS

O-100 Milliamps Flush Mtg.	$ 8.00
O-250 Milliamps Flush Mtg.	8.00
O-500 Milliamps Flush Mtg.	8.00
O-15 Volts Panel Mtg. back-con.	10.00
0-500 Volt Meter	16.00
O-1000 Volt Meter	23.00
O-1500 Volt Meter	30.00
O-1, O-2, O-2½, O-5, Thermo coupled Radiation Meter Flush Mtd.	12.00

MOTOR GENERATORS

Westinghouse 100 Watt 110 Volt 60 cycle AC 500 Volt DC	$ 80.00
Westinghouse 250 Watt 110 Volt 60 cycle AC 1000 Volt DC with 87 Volt Grid Bias Tap	142.50
Pacent Universal CW Condensers, any capacity	2.00
CW Tuning Inductance	3.00
Variable Grid Leak 5000 ohm	3.00
Wireless Shop Condenser .0008	3.00
231M Modulation Transformer	5.00
Kellogg Transmitter	3.50
Kellogg Transmitter, adjustable arm	4.75
IMF-21AA Western Electric Filter Condenser	2.75
Double Filter Choke	6.00

Send For Your Copy of New 32-Page Remler Catalogue Just off Press. DEALERS: Our Stock Guarantees Service. Send For Special Co-operative Plan.

LEO J. MEYBERG CO.

428 Market Street
SAN FRANCISCO, CALIF.

752 South Los Angeles Street
LOS ANGELES, CALIF.

This letter was Unsolicited

Kico "B" Battery

Kico Storage "B" Batteries will end your troubles. Years of Real Service, Saves you money in the end. One charge lasts 3 to 6 months. Short circuiting, overcharging, standing idle **DOES THEM NO HARM.** Beautifully constructed. Hand finished. Following prices include Rectifiers, chemicals and directions. One quart of distilled water and your battery is in service.

	Plain	With Panels
24 Cells. 32V.	$8.00	$10.00
36 Cells 48V.	10.00	12.00
50 Cells 68V.	12.00	15.00

Money refunded if unsatisfied after three months trial.

Charlottesville Radio Club
Room 405 National Bank Bldg.
Charlottesville, Va.

Kimley Electric Company,
Gentlemen:

It is with great pleasure that I am writing this letter to express to you the satisfaction I have obtained with the Storage 'B' Battery that I purchased from you some time ago.

Your claims for it are far from being good enough to cover all the good points that I have found for it since it has been installed at this station.

I will be glad to recommend it to the radio Fraternity as I desire to have all Radio men know just how and where a real Storage "B" Battery can be purchased.

Very truly yours:
(Signed) Fred T. Bradley
Radio 3BHL. Sec't'y.

KIMLEY ELECTRIC CO.
290 WINSLOW AVE., BUFFALO, N. Y.
Further information gladly furnished on request.

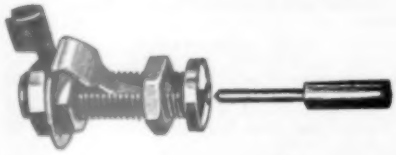
Kico "A" Batteries

(Acid Proof)

No more acid eaten rugs, furniture, etc. Truly a parlor battery designed especially for wireless den. Built sturdy enough to kick over Ford, Chevrolet or any car taking battery 9¾"x 7⅜". Box and jars moulded in one piece from acid proof composition many times tougher than hard rubber.

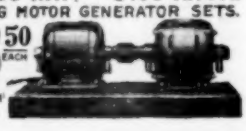
6 volt 80 to 100 A. Hrs. $24.00 Guaranteed 18 mos. Same battery in neat wooden box $21.00 F. O. B. Buffalo.

No. 122 Cord Tip Jack



Attractive proposition to dealers
Send for Bulletin No 7
A. W. BOWMAN & CO.
154 West Lake St., Chicago, Ill.
Factory, Cambridge, Mass.

NEW MOTORS FOR ALL PURPOSES STANDARD MANUFACTURERS PROMPT DELIVERY
ALL SIZES UP TO 5 H.P.
We Specialize In Small Motors & Generators
ALL PHASES AND FREQUENCIES IN STOCK AT ALL TIMES
Largest exclusive Mail Order Small Motor dealers in the world.
CHAS. H. JOHNSTON, Box 19 West End, Pittsburgh, Pa.
WIRELESS, TELEPHONE GENERATORS
500 VOLT - 100 WATT - 3400 R.P.M.
FOR MOUNTING MOTOR GENERATOR SETS.
$28.50 EACH
WRITE FOR CATALOG



SAVE YOUR MONEY

The saving of money is the foundation of wealth. To assist you to save systematically we will sell you any sound 6% to 9% income paying Railroad, Steel, Public Utility or Industrial Stocks or Bonds, which you select, and allow you 20 months to pay for same. Liberty Bonds sold on terms of 10% down—balance 20 monthly payments. Write for copy of pamphlet PP2.

GORDON, HECK & CO., Inc.
Stocks and Bonds
44 BROAD STREET, NEW YORK

FILTER CONDENSERS

.25 MFD —25 CTS.
(500 VOLT TESTED)

DAVID L. MOORE
FARMINGTON, CONN.

C-W C-W C-W C-W C-W C-W C-W C-W

CW Filters
CW Plate Transformers
CW Condensers
CW Filament Transformers
CW Iron Core Chokes
CW Radio Frequency Chokes

CW Power Tubes
CW Rectifier Tubes
CW Sockets
CW Rheostats
CW Microphones
CW Tone Arms
CW Modulation Transformers

WIMCO CW 100 INDUCTANCE

Get the BEST CW Inductance. Real connection clips provided, no uncertain switches which short circuit turns. Entirely insulated on Formica, high conductivity copper, very efficient. Made in 25 and 50 turn sizes, priced at $10.00 and $13.50 respectively. Also sold in parts ready to assemble.

We distribute the only complete line of panel type meters in America—Thermoammeters, AC and DC Voltmeters, Ammeters and Milliammeters. You can now equip your set with a complete set of meters all alike.

Big line of high voltage generators and motor-generators reasonably priced—just what you have been looking for.

SPECIAL NOTICE

Grid coils for the above CW Inductance are now supplied so that the circuit described in July QST can be employed—and take it from us it is the REAL amateur circuit. Grid coil for the CW 100 Inductance priced at $2.00. Ask for our new bulletin containing full dope on this circuit—try it on your own set, it's a winner.

Antenna Specials

Now is the time to remodel your antenna and we are especially prepared to supply your needs in solid copper, stranded copper and copper-weld aerial wire.

Ask about the New Air Gap Type

Antenna Insulators—wonderful for CW—priced right—positively superior to present forms and materials.

Send for special Antenna Material Bulletin or send 15c in stamps for catalog and complete literature.

8ZV WIRELESS MANUFACTURING CO. 8ZV

CANTON, OHIO

WIMCO apparatus is distributed in Canada by Ontario Radio Laboratory, Sault Ste. Marie, Ont.

ACME
APPARATUS

DETECTOR WITH
POTENTIOMETER

$10.00

SINGLE STAGE AMPLIFIER

$13.00

Ideal apparatus for receiving telephone concerts

The Detector contains tube socket, condenser, grid leak, filament rheostat, A battery and wire wound Potentiometer.

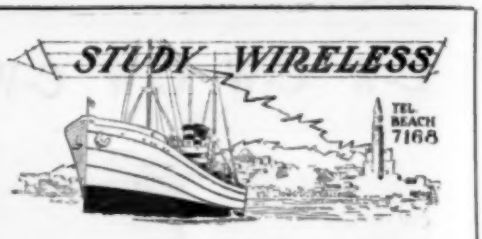
The Amplifier contains tube socket, ACME Amplifying Transformer, and filament rheostat.

Acme Apparatus Co.

194 Massachusetts Avenue,
CAMBRIDGE 39, MASS.

Transformer and Radio Engineers and Manufacturers

NEW YORK SALES OFFICE
1270 Broadway



Do You Want a First Class Commercial License?

When you decide to train for the wireless service bear in mind the fact that the *Mass. Radio and Telegraph School has graduated more first grade and first class licensed operators* during the past *11 months* and has TODAY a larger enrollment than any other Radio School in New England. **Send for our 44-page catalog giving full particulars to prospective students.**

RADIO ENGINEERING

Classes meet each Thursday evening at 6:00 P.M.—enrollment limited. Subject: Design of Commercial Tube Transmitters.

WIRELESS TELEPHONY

CW-ICW, Vacuum Tubes, Classes every Tuesday evening at 6:00. Send for particulars.

AMATEUR CLASSES

Every Saturday morning from 10 A.M. to 12 noon—prepares for amateur license.

SALES—C-W—SERVICE

We carry a full line of Radio equipment and are counsellors on all radio problems, especially complete receiving and transmitting installations. Order from any standard catalog—mail orders filled. Our technical staff is at your service.

OPEN EVENINGS

Open three evenings per week. Monday, Wednesday and Friday until 9:30 P.M. and Saturday afternoon.

G. R. ENTWISTLE, Radio Director
R. F. TROP, Telegraph Director

MASSACHUSETTS RADIO and TELEGRAPH SCHOOL, Inc.

18 Boylston St. Boston, Mass.

Formerly Boston School of Telegraphy
Established 1903

RADIO CORPORATION PRODUCTS

We are distributors and jobbers for the Radio Corporation of America and always carry a complete stock of their apparatus. We list below their complete line and in addition can supply you with the Radio Corporation C.W. instruction book at 25c per copy.

VACUUM TUBES

Item		List Price
1	Radiotron (detector) UV200	$5.00
2	Radiotron (amplifier) UV201	6.50
3	Radiotron (5-watt) UV202	8.00
4	Radiotron (50-watt) UV203	30.00
5	Radiotron (250-watt UV204	110.00

POWER TRANSFORMERS FOR C. W. SETS

12	325-watt, UP1368	25.00
13	750-watt, UP1016	38.50
	A—Filament heating Transformer for UV204, UP1633	
	B—Power Transformer for UV204, UP1636	

C. W. ACCESSORIES

14	Oscillation Transformer UL1008	11.00
15	Magnetic Modulator (½ to 1½ amp.) UT-1643	9.50
16	Magnetic Modulator (1½ to 3½ amp.) UT1357	12.00
17	Magnetic Modulator (3½ to 5 amp.) UT1367	17.00
18	Filter Reactor (160 milliamp.) UP1626	11.50
19	Filter Reactor (300 milliamp.) UP1627	15.75
20	Plate Circuit Reactor, UP415	5.75
21	Filter Condenser ½ mfd.—750 V., UC1631	1.35
22	Filter Condenser, 1 mfd.—750 V., UC1632	1.85
23	Filter Condenser, ½ mfd.—1750 V., UC1634	1.50
24	Filter Condenser 1 mfd.—1750 V., UC1635	2.00
25	Transmitter Grid Leak (5-watt tubes), 5000 ohms, UP1719	1.10
26	Transmitter Grid Leak (50 & 250-watt tubes), 5000 ohms, UP1718	1.65
27	Antenna Ammeter, 0-2.5 amp., UM530	6.00
28	Antenna Ammeter, 0-5 amp., UM533	6.25
29	Sending Key UQ809	3.00
30	Microphone Transformer UP414	7.25
31	Filament Rheostat (for UV200, 201 and 202) PR535	3.00
32	Filament Rheostat (for UV203 and 204) PT537	10.00
33	Rotary Grid Chopper PX1638	7.25
34	Shaft Bushings for ¼" or ⅛" motor shaft	.20

KENOTRON RECTIFIERS

Item		List Price
6	20-watt Kenotron, UV216	$7.50
7	150-watt Kenotron, UV217	26.50

VACUUM TUBE SOCKETS

8	Porcelain Socket (for UV200, 201, 202, 216) UR542	1.00
9	Porcelain Socket (for UV203 and UV217) UT541	2.50
10	Bakelite Socket (for UV200, 201, 202, 216) UP552	1.50
11	Mountings (250-watt tube) UT501, UT502	2.00

SPECIAL CONDENSERS FOR C. W. SETS

35	Antenna Series Condenser, 7500 V. .0003, .0004, .0005 mfd., UC1015	5.40
36	Plate and Grid Condenser—3000 V. .002 mfd., UC1014	2.00
37	Special Condenser—10,000 V. .000025 mfd., UC1803	5.00
38	Special Condenser—.002 mfd., 6000 V., UC1806	7.00

VACUUM TUBE DETECTOR ACCESSORIES

39	Intervalve Amplifying Transformer, UV712	7.00
40	Special "A" Battery Potentiometer, PR536	2.00
41	Tubular Grid and Plate Condenser	
	.00025 mfd. UC567	1.20
	.0005 mfd. UC568	1.35
	.001 mfd. UC569	1.50
	.0025 mfd. UC570	2.00
42	Grid Leaks	
	UP509, .05 megohm UP518, .75 megohm	
	UP510, .1 " UP519, 1.0 "	
	UP511, .15 " UP520, 1.25 "	
	UP512, .20 " UP521, 1.5 "	
	UP513, .25 " UP522, 1.75 "	
	UP514, .30 " UP523, 2.00 "	
	UP515, .40 " UP524, 2.50 "	
	UP516, .50 " UP525, 3.00 "	
	UP517, .60 " UP526, 4.00 "	
	UP527, 5.00 " each,	$0.75
43	Grid Leak Mounting UX543	.50

CUT PRICES ON OVER-STOCK OF OTHER EQUIPMENT

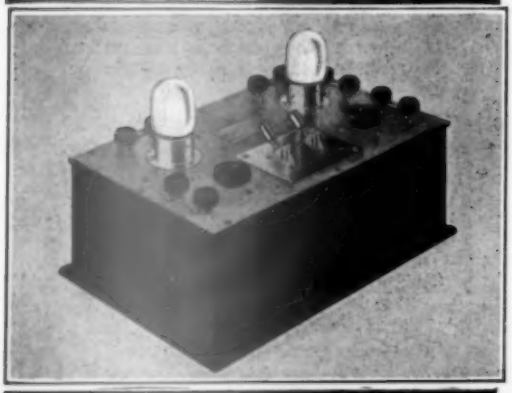
	List Price	Our Price
Acme F.1 fully-mounted 1 K.W. transformer with choke coil	$45.00	$35.00
Acme H.1 fully-mounted ½ K.W. transformer with choke coil	30.00	22.50
Acme 500 fully-mounted ½ K.W. transformer without choke coil	22.00	17.50
Acme 250 unmounted ¼ K.W. transformer without choke coil	13.00	10.00
Mesco 1 K.W. keys with ¼ inch silver contacts	4.00	2.75
Tuska C. W. Inductance Type 181A	5.00	4.00
L-104 Regenerative receiving transformer (loose-coupler)	29.50	20.65
L-103 Regenerative receiving transformer (loose-coupler)	23.50	16.45
L-102 "Standard" receiving transformer (loose-coupler)	19.50	13.65
121 Single capacity fixed phone condenser .005 M. F.	1.50	.80
122 Double capacity fixed phone condenser .005 M. F.	1.80	1.00
123 Double capacity fixed phone condenser .005 M. F. with switch	2.50	1.40
DeForest CV-500 condensers-ideal for C.W. work; .0005 M. F.	5.25	4.50
‡115 Crystal detector complete with galena and cats-whisker	1.60	1.00
‡117 Crystal detector complete with galena or silicon	2.15	1.50
‡110 Crystal detector complete with galena or silicon	2.10	1.45

Send 15c for our complete literature.

ELECTRICAL SPECIALTY COMPANY

48-50 SOUTH FRONT ST., COLUMBUS, OHIO.

RADIO MAGNAVOX



NEW

MAGNAVOX
2-STAGE AND 3-STAGE

POWER AMPLIFIERS

Illustration shows the **New Magnavox** 2-Stage Power Amplifier designed particularly for use with the Radio Magnavox for the distortionless amplification and reproduction of Radio telephone speech and wireless music in volume. Use of this Power Amplifier insures your getting the largest possible power input from your Radio MAGNAVOX. Note the master switches, making stage to stage switching quick, simple and easy. No jacks. Can be used with any transmitting tube with any voltage up to 1,000; and sets either flat or on edge. Type AC-2 Model C, as illustrated, price complete in solid mahogany case **$80.** At your dealer or direct from factory.

MAGNAVOX 3-Stage Power Amplifier, Type AC-3 Model C, same as above only 3-Stage, Price $110.

Dealers write for proposition

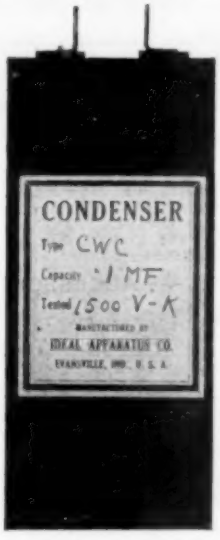
REG. U.S. PAT. OFF.

THE MAGNAVOX CO.

GENERAL OFFICES & FACTORY
OAKLAND, CALIFORNIA
NEW YORK OFFICES
370 SEVENTH AVE. PENN TERMINAL BLDG.

IDEAL

FILTER CONDENSER



Type ICC

The Ideal Condensers have met with great favor in radio circles throughout the country, all because of their super-efficiency.

Recently designed to stand potentials of 2000 Volts without puncturing, and at no increase in price.

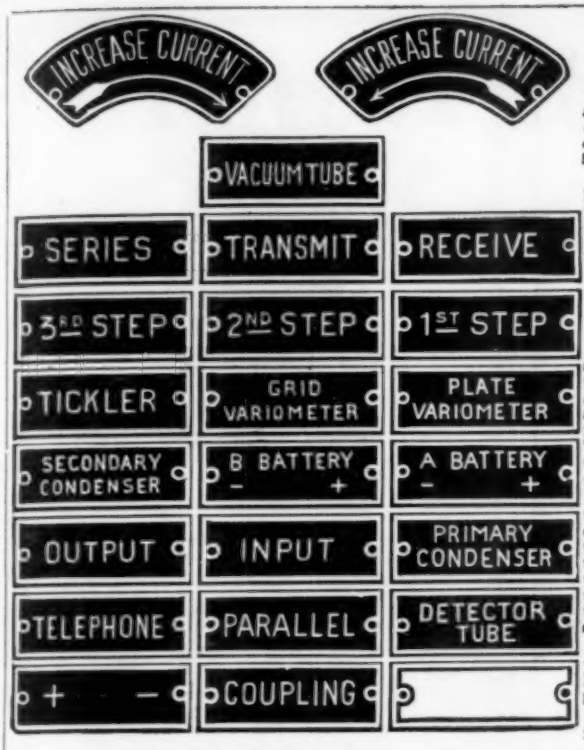
These attractively priced condensers may be obtained from any of the dealers listed below. They will furnish you with complete information regarding the IDEAL LINE.

1 Mfd 2000 Volt Condenser $2.00
2 Mfd 500 Volt Condenser 1.50

Somerville Radio Lab., Boston, Mass.
Benwood Company, Inc., St. Louis, Mo.
Pitt. Radio & Appli. Co., Pitts., Pa.
Hemple Electric Co., Omaha, Nebr.
Klaus Radio Co., Eureka, Ill.
Standard Radio Co., Los Angeles, Calif.
Nola Radio Co., New Orleans, La.
John R. Koch, Charleston, W. Va.
Cino Radio Mfg. Co., Cincinnati, O.
T & H Radio Company, Anthony, Kansas
Wireless Mfg. Co., Canton, Ohio
Northern Radio Co., Seattle, Wash.

C-W CATALOG FREE

IDEAL APPARATUS COMPANY
EVANSVILLE,
"9XAH" INDIANA "9XAH"



"RASCO" BRASS NAME PLATES

Illustrations are in full size. Order by name.

The two top plates, "Increase current," list at 10c each, illustrations full size. All others are 5c each. We also have these, not illustrated: Phones, Loading Coil, Aerial, Ground, Secondary, Primary, Audion, Detector, Off, On, each 5c. In dozen lots, 50c prepaid.

NEW. The white plate in the lower right-hand corner is blank, and made of such material that you can write your own lettering on it with pencil, ink or China ink. Price each 5c.

"RASCO" AUDIO FREQUENCY TRANSFORMER

This transformer has been developed by us after comparing all the various transformers on the market. This transformer is guaranteed to equal any on the market today. The primary and secondary are very carefully built and are impregnated with a certain wax in vacuum. The stampings are of the best silicon steel. Only the very best material is used throughout.

Realizing the fact that most amateurs desire to "make their own" **we furnish this transformer unassembled.** Directions which accompany the transformer are such that anyone can put the parts together in about ten to twelve minutes. This saves you considerable money, for the reason that manufacturers who assemble the transformers must charge you for the assembling work.

Illustration as shown is in full size. The weight complete is ten and one-half ounces. **Note also that we ship all goods prepaid. We pay the freight.**

No. 1100 "Rasco" Audio Frequency Transformer **NOT ASSEMBLED,** prepaid

$2.65

A COLOSSAL EVENT

THE "RASCO" CATALOG

There are many radio catalogs, but the "Rasco" catalog marks a radical change for the simple reason that it

Contains 50 Vacuum Tube Hook-Ups

This is the one and only radio catalog containing such wonderful free information. Complete hook-ups of all important vacuum tube circuits are given in clear diagrams with complete explanation. Just to name a few.—The V.T. as a detector; detector and one-step amplifier; regenerative circuit; DeForest ultraudion; V.T. to receive undamped and spark signals; Armstrong circuits; one step radio frequency amplifier and detector; three stage audio-frequency amplifier; short wave regenerative circuits; V.T. radio telephone; 4-stage radio frequency amplifiers; radio and audio frequency amplifier, Inductively coupled amplifier; Armstrong superautodyne; radio frequency amplifier and crystal detector; C.W. transmitters; self-rectifying 2 tube C.W. transmitter; V.T. transmitter with 6 volt battery; radiophone using plate and grid modulation; one tube radio transmitter and receiver; experimental radiophone; radiophone using Colpitts oscillator circuit.

The catalog contains 185 illustrations. On account of its great cost, this catalog cannot be distributed free of Charge. It will only be mailed upon receipt of

15c IN STAMPS OR COIN

WE GUARANTEE EVERY ORDER SHIPPED WITHIN 24 HOURS

DEALERS
Get Our Special Proposition

Radio Specialty Co

100 PARK PLACE, NEW YORK CITY

Factories: Brooklyn, N. Y.—Elkridge, Md.

Remember that this business was originated with the sole purpose to cater to the amateur who has small orders. ALL OF OUR ORDERS ARE SMALL and that is why your small order will never be side-tracked by us. A trial order will make you a life customer. You can order from the above illustrations. "We can only stick you once." Try us with a 50c order.

160 to 600 meters, use

THE SORSINC TUNIT

THE SORSINC "TUNIT", when attached to your Honeycomb coil set, duplicates the performance of the most expensive short wave sets, on 160 to 600 meters, at a price any amateur can afford.

Use the Sorsinc "TUNIT" in your present standard triple coil mounting. "TUNIT" is now on the market. Examine it at your dealers' or at any of the Sorsinc Branch Stores listed below.

PRICE, $15.00

Write for Free descriptive folder.

Ship Owners Radio Service

INCORPORATED

80 Washington St., New York City

SORSINC

"Largest Radio Chain Store System in the World"

Branch Office Stores:

NEW ORLEANS, 710 Maison Blanche Annex.
BALTIMORE, 403 Lobe Bldg.
NORFOLK, 26 Haddington Bldg.
SAVANNAH, 230 Broughton St., East.
PHILADELPHIA, 2006 Columbia Ave.
PORTLAND, ORE., 622 Worcester Bldg.
HONOLULU, 408 Boston Bldg.
SEATTLE, 215 James St.

Branch Offices:

BOSTON, 175 Commercial St.
SAN FRANCISCO, 24 California St.
LONDON, 15 City Chambers, 65 Fenchurch St., E. C.

Your name and address on a postcard brings the new Sorsinc folder of latest apparatus at newest prices by return mail. Absolutely FREE. Send for it at once, before you buy any new instruments. Prompt mail order service from every branch.

FEDERAL Radio Apparatus is the choice of thousands of amateurs and professionals because of its high standard of quality and particularly because it is built to conform to Government Specifications.

FEDERAL

AMPLIFYING TRANSFORMERS

One of the most noted radio laboratories in the country gives the following data:

One Federal 226-W type A Audio Frequency Transformer with one Marconi V.T. gives an energy amplification of 400 times (Audibility amplification of 20 times.)

Two Federal No. 226-W type A Audio Frequency Transformer with two Marconi V.T. gives an energy amplification of 160,000 times (Audibility amplification 400 times.)

FEDERAL UNIVERSAL PLUGS

made of Bakelite and designed to take any type of conductor without soldering; are attractive in appearance; simple in construction.

For plugging in head telephone sets, power supply, microphone transmitters, transmitting keys, or as many other things that an ingenious radio operator may think of.

A decided improvement over the ordinary telephone switchboard plug.

PRICE IN U.S.A. $1.75

Write for more complete data on FEDERAL Wireless Equipment. Send for Bulletin 103-WB.

FEDERAL TELEPHONE AND TELEGRAPH CO.
BUFFALO, N. Y.

"The Watchdog of the Tube"

This announcement is of vital interest to every Radio Amateur who desires to

(a) Obtain the best possible results from his tubes, and

(b) Secure maximum life with minimum replacement of his tubes.

Weston

is a name known all over the world, wherever electrical measuring instruments are used. Weston Instruments are the universally accepted *standards* of precision and workmanship. This could not very well be otherwise, because the founder and President of the Company, Dr. Edward Weston, originated the art of electrical measurement as it is practiced today; he and a staff of the most expert instrument engineers have been constantly perfecting Weston Instruments for the past thirty-three years. It is noteworthy that the Company has thus contributed practically every improvement or advancement to the art.

These facts are worthy of careful consideration when instrument purchases are contemplated. The price of Weston Instruments, because of their quality of workmanship, is necessarily a trifle more than the prices established by other instrument manufacturers, but is very little more than the cost of a new tube.

The Weston line of Radio Instruments comprises Voltmeters, Milliammeters, Ammeters and Antennae Ammeters.

These are facts of exceeding interest because whether you prefer to use an ammeter for controlling the filament current of your tubes, or whether you are following the later practice of filament voltage control, you can procure a suitable Weston Instrument at slightly more than the cost of a single tube.

The use of an accurate voltmeter for filament voltage control should prolong the life of your tube by an amount at times reaching 300 per cent. Compare such a result with guesswork or with control with an instrument upon which you cannot positively rely.

Each Weston Instrument will last a lifetime, with reasonable care, and will provide a constant means of proper regulation for receiving, amplifying or transmitting tubes.

Remember, there are Weston Instruments available for every Receiving or Transmitting requirement.

Tell your dealer you want a Weston Instrument and write to us for Radio Circular "J", so that it may be forwarded to you as soon as it is received from the press. If your dealer cannot immediately supply your needs write to us, giving his name and address, and we will furnish what you need from our stock. Address

Radio Department

Weston Electrical Instrument Company

158 Weston Ave., Waverly Park, Newark, N. J.

The RHAMSTINE* VT Battery

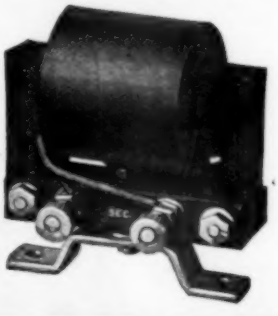
$3.00

Add 30c. for Postage and packing West of Rocky Mts. 50c.

Recently announced has met with widespread approval. See it before you buy any other make.

Variable. 1½ volts to 22½ volts Plated switch mounted on Bakelized Panel. Large cells. Overall size—2¾"x4½"x7⅛". Shipping weight 5 lbs.

It is a piece of apparatus rather than an accessory.



The Rhamstine* Amplifying Transformer

$3.50

Postage and Packing 10c.

Thousands of these efficient transformers have been sold. They are recognized as the equal of the more expensive makes. Procurable from your dealer or order direct. Complete Folder upon request. Manufactured by

J. THOS. RHAMSTINE*

2152 E. Larned St., Detroit, Mich.

KUEBLER RADIO SERVICE

PANELS CUT TO ORDER --- A NEW SERVICE

We cut panels to exact size from Bakelite 1-16 to ⅜", Formica 1-16 to ⅜", Fibre 1-16 to ½" thick.

Drilling Holes up to ½" @ 3c each.

Engraving—Letters or figures—5c each, 180 scale—75c each.

A NEW WIRELESS LOOSE LEAF CATALOG

Send 10c, stamps or coin —100 pages all wireless sending and receiving sets. You get regular up-to-date radio bulletins.

The KUEBLER RADIO CO.
Successors to
Marshall-Gerken Co.
Retail Dept. 121 Gibbs Bldg.
Toledo, Ohio

Reliable Receiving Apparatus

Assemble your own receiving set and save money. The following parts will make a reliable set, which will copy signals on wave lengths from 170 to 350 meters.

Variable Condenser .0005 Mfd.	$3.60
Remler Variocoupler	5.40
Remler Variometers (two required)	6.00
Remler Vacuum Tube Detector Panel	8.00
Radiotron or A.P. Detector Tubes	5.00
Burgess "B" Battery (small size)	2.25
Dial with Knob (for Variocoupler etc.) each	1.00
Antenna Wire, #14 copper per 100 ft.	.50
Antenna Insulators (air gap type) each	1.50

Write for our price list on standard radio equipment. Satisfaction guaranteed or money refunded. Remember we prepay all express charges.

The Washington Radio Laboratories
5320 ILLINOIS AVENUE,
3XL WASHINGTON, D. C. 3XL

"SHRAMCO PRODUCTS"

Amateurs: Send 5c in stamps today for our new Catalogue L showing complete line of parts, raw materials and high grade apparatus.

Dealers: Write for our attractive proposition.

The Shotton Radio Mfg. Co.,
INCORPORATED
8 Market St., Albany, N. Y.

INSTEAD OF JACKS!

Our Rotary Amplifier Control Switch with Automatic Filament Control. Changes from detector to any desired stage by slight turn of knob. For detector and 1, 2 or 3 stage amplifier complete, knob with pointer and diagram. For panel mounting, size 1⅝x1⅝x2½. Picture and further details in our folder, sent on request.

Price $6.00

For best results our Edgewise-wound CW Inductance. ¼"x.05 copper strip, 35 turns 5½" in diameter, bakelite insulation, finest workmanship, 3 insulated clips furnished. Send for photo.

Price $9.00

Hinge type Oscillation Transformer 1" brass ribbon, bakelite insulation, regular $12.00.

While they last $6.50

1⅝" Navy Type Knob 10-32 threaded bushing. With pointer....35c. Without pointer....15c.

We will quote lowest possible prices on any raw materials, parts or apparatus you may require.

STORM-LEE RADIO APPARATUS CO.
742 Highland Ave., Newark, N. J.

RADEX

"Service That Satisfies."

Chi-Rad set $8; panel 7x18 or 6x21 $1.75; Baldwin type F $15.75; France charger $14; Radiotron UV200 $4.50; UV201 $6; Large stock leading makes at attractive prices. Request bulletin.

THE RADIO EXCHANGE
STROH, 9DBQ IND.

BUZZERS

"HYTONE"
for radio work. External tone adjustments.
Price 60c postpaid

AJAX ELECTRIC CO.
28 Palmer St., Cambridge, Mass.

ONE OF THOSE FIT-UR BODY-BEDS
RADIO FONE
WAKE UP O.M.!
THE DECREMENT OF THESE SPRINGS IS AWFUL!
ITS BAD THOUGH WHEN YOU DEVELOP ANTENNA TROUBLE! IT'S SOMETHING LIKE REPAIRING A FORD - YOU GET UP AND GET UNDER!
ALARM CLOCKS WILL NOW GO INTO HISTORY - ALL YOU HAVE TO DO IS TAKE A C.R.L. Z-NITH REGENERATOR PLUS AN AGN-2 AND — HOOK 'ER TO YER BEDSPRING!
SPOOKS!! WOOOH HA
RRRK HELLO 1-2-3-4-ROK ZINK POP!
ALL BY HIMSELF-AT NIGHT!
HEARKEN - YOU FELLOWS WHO CANT ERECT AN AERIAL — READ WHAT YOU CAN DO WITH A C.R.L. ZNITH REGENERATOR, AN AGN-2 STEP AND A BED SPRING —!!
WIRELESS EARS
BED SPRING LOG
RADIO 9CD
HERE WE HAVE A FOTO OF THE YOUNG MAN WHO PUTS THE IDEA TO SUCH A VERY PRACTICAL USE!
FRED MARCO
Y'OUGHTA SEE HIM A.W.'S!!
I MIGHT ADD THAT ITS NOT BUNK!! I WENT TO MARCOS HOUSE ONE NIGHT AND I ACTUALLY HEARD THE CHICAGO GRAND OPERA OVER 12 FEET FROM THE FONES - ALL ON A 3/4 SIZE BEDSPRING
WOODEN BEDS don't WORK—!! (41)
9DQ's '21

SEE IF YOUR CALL IS HERE!

We Don't Expect You to Junk Your Aerial But The attached call list shows just how sensitive the Z-Nith Regenerator-Amplifigon combination is.

You don't need a big complicated antenna system to receive radiofone, CW or spark signals when a *real* Regenerator is used, with balanced variometers, and a minimum of distributed capacity in the windings.

The pleasure of copying messages from amateur, commercial and broadcast stations throughout the country can be yours with a minimum of effort. Write us for full details.

Stations copied Oct. 30 to Nov. 26 at station 9CD, using Z-NITH Regenerator & Amplifigon AGN-2 on a **BED-SPRING AERIAL**, absolutely **NO OTHER** antenna being on or near the premises.

(Signed) F. J. Marco, 9CD
5723 Winthrop Ave., Chicago.

SPARK: 1AW, 2BK, 2FP, 2OM, 2OX, 2TS, 2UE, 2AID, 2AQI, 2CAP, 3HJ, 3HX, 3PU, 3XC, 3XF, 3ZA, 3ZO, 3AHK, 3BFU, 4AG, 4AGR, 5EK, 5FO, 5HK, 5IF, 5JD, 5XU, 5YL, 5YM, 4ZL, 6EN, 6KA, 7XD, 7ZO, 7ZU, 8AL, 8AY, 8BM, 8DJ, 8DZ, 8EA, 8EB, 8FI, 8FT, 8GW, 8HU, 8HY, 8IN, 8JP, 8JQ, 8MZ, 8OI, 8PM, 8QQ, 8RQ, 8RU, 8SP, 8TK, 8TT, 8UC, 8VL, 8VQ, 8WA, 8XE, 8YN, 8YM, 8YO, 8ZA, 8ZF, 8ZN, 8ZP, 8ZY, 8ACF, 8AFD, 8AFS, 8AGG, 8AGK, 8AHS, 8AMB, 8AMZ, 8ANO, 8ARD, 8ARS, 8ASR, 8ATU, 8AVO, 8AYN, 8BDY, 8BEN, 8BEP, 8BRL, 8BVA, 9AR, 9DV, 9EE, 9EL, 9ET, 9GP, 9HM, 9HT, 9JN, 9JQ, 9JV, 9LW, 9MC, 9OF, 9OX, 9PB, 9PS, 9QJ, 9QR, 9RU, 9TL, 9UH, 9UW, 9VG, 9WI, 9WT, 9WU, 9XI, 9XM, 9YB, 9YO, 9YM, 9YQ, 9YAC, 9YAE, 9ZB, 9ZJ, 9ZAA, 9ZAC, 9ACB, 9ACL, 9ACN, 9AEG, 9AEY, 9AGG, 9AGR, 9AIR, 9ALH, 9AMA, 9AMT, 8AMV, 9AOJ, 9AOU, 9AQE, 9AQM, 9ARG, 9ARZ, 9ASJ, 9ASL, 9AUE, 9AVP, 9AWU, 9AXU, 9AYV, 9AZE, 9BDE, 9BFR, 9DKV, 9DRJ, 9DSD, 9DQQ, 9DZI, 9DZZ, "MSP"-Canuck 3BP, 3JL.

C.W.—I.C.W.—FONE: 1ID, 1TS, 1XE, 1AFV, 1AGI, 1CGG, 2DN, 2EH, 2FD, 2FP, 2KL, 2MW, 2QB, 2RU, 2WP, 2XA, 2XQ, 2ZL, 2ABR, 2AFP, 2AKO, 2AWL, 2BAK, 2BGM, 3BA, 3BZ, 3CC, 3EM, 3FM, 3GB, 3MO, 3RF, 3XM, 3ZN, 3ZO, 3ZY, 3ZZ, 3AAE, 3ASW, 3BIY, 4BK, 4BQ, 4BY, 4CD, 4GL, 4JI, 4XC, 4ZE, 5DA, 5ZA, 6ALE, 6WV (voice), 6XAD, 8BA, 8BK, 8BO, 8CI, 8DE, 8DR, 8GE, 8IB, 8IT, 8IQ, 8JL, 8LF, 8LU, 8OH, 8QU, 8RU, 8TG, 8UJ, 8UK, 8ZD, 8ZG, 8ZN, 8ZZ, 8AAZ, 8ACF, 8AGZ, 8AIO, 8AKS, 8AND, 8AOA, 8AOU, 8AQF, 8AQR, 8AQZ, 8ARW, 8AWP, 8BDU, 8BEF, 8BFX, 8BJC, 8BNJ, 8BOW, 8BUM, 8BXU, 9AK, 9DV, 9FA, 9FM, 9HD, 9II, 9IO, 9JD, 9JI, 9LQ, 9RT, 9VE, 9XI, 9XM, 9ZY, 9ZAE, 9AAS, 9ADI, 9AKR, 9AMB, 9ARK, 9AXE, 9AZE, 9BHG, 9DWJ, NMW, NSF, NX4, XF1, KDKA, Canuck 2BF, 3BP, 9AW.

Best for CW, Phone or Spark

Look over this list and note that all classes of stations are represented from 1AW's spark to 6ALE's CW and 6WV's 'phone.

If you've never heard one of the new improved Z-NITH Regenerators in operation, visit the fellow in the next block who has one, and we will not need to use any more sales arguments on you.

Our new catalog F-22 will be out February 1st. If you are not already on our mailing list, Write us.

Chicago Radio Laboratory, 6433 Ravenswood Ave., Chicago, Ill.

R. H. G. Mathews—President K. E. Hassel—Secretary

CLASSIFIED ADVERTISEMENTS

Five cents per work per insertion, in advance. Name and address must be counted. Copy must be received by the 10th of month for succeeding month's issue.

SELL: New Grebe CR Six $150, two pair "Transatlantics" new $9.50 each, Thordarson new 1 KW OT $5. R. F. Fowler, Frankfort, Indiana.

STOP! LOOK! and ACT! V.T.'s and Accessories. With each of the listed tubes—Radiotron UV200 $5.00, and A.P. Moorhead Detectors $5.00; Radiotron UV201 $6.50 and A.P. Moorhead Amplifiers $6.50; We will supply free of charge your choice of either of these four premiums—Latest FADA Rheostat $1.00, No. 810 Remler Bakelite Smooth Running Rheostat $1.00; R.C. of A. Porcelain V.T. Socket $1.00; Murdock V.T. Socket, improved contact type $1.00. Either of the Federal single, closed or double circuit jacks listed respectively at $0.70, $0.85 and $1.00, will be given as premiums with each R. C. of A. or Federal amplifying transformer, price $7 each. Fada 5 ampere Nichrome power rheostats, $1.35 or R. C. of A. porcelain V. T. Socket supplied free of charge with each $8.00 UV202, 5 watt Radiotron power tubes for C.W. or Radiotron Transmission. We absolutely guarantee the foregoing apparatus. Only new and high grade equipment carried in stock. Unsatisfactory goods returned in five days replaced at once. All orders are filled within twelve hours and shipped postpaid and insured, thereby saving time and money. Remember us. The Kehler Radio Laboratories, Dept. R., Abilene, Kansas.

SELL: DeForest twelve panel receiver, one stage amplifier, with coils, $65. Harold Koontz, Buffalo, Wyo.

FOR SALE: ½ KW Cutting and Washington Impulse Excitation 500 cycle transmitter complete with alternator. .R. C. Higgy, care QST, Hartford, Conn. . . . . .

½ KW Rotary Gap $8.00, 1 KW Acme New Type 15000 volts $25.00, ½ KW Flex Thordarson $10.50, 6 volt Amrad Spark Coil, OT and Condenser $20.00. A. Hubner, 414 Herman St., Cincinnati, O.

Western Elec. Aeroplane Microphones $5.00, W. E. Carbon Cup Microphone $0.50, W. E. 21AA. 1000 volt 1 mfd. Con. $1.50, Filter System $7.00, Choke Coil, single unit for both legs of line $1.00, Litz Wire 25-32 1c ft. 46-32 2c ft. 10-38 per lb. $1.00, Complete parts for short wave rec. $18.00, Complete parts for Two stage amplifier inc. Cab. & Panel $21.00., High Grade Variometer $4.00, Vario Coupler $3.75, Bakelite Tubing 3" diam. at 6" 25c, 8" 35c, 12" 45c, 3 ft. length $1.00, Bakelite tube Elliptic equiv. 5" diam. 3½" long, $15. Postage Extra. Send for catalog. Haupt Radio Supply Co., 2442-44 Ogden Ave., Chicago, Ill.

PARAGON RA6 almost new in perfect condition $45. John Lucas, 547 Bruce Ave., Stratford, Conn.

QRA de 9BHS, 3600 Gladstone Blvd. Kansas City, Missouri.

RADIO STORAGE BATTERIES. 6 volt 40-60 amp., $10.00; 6 volt 60-80 amp., $12.00. All brand new and guaranteed. W. & G. Tufts, 336 Newbury St., Boston, Mass.

SACRIFICE: ½ KW Thordarson transformer, 4 sections Murdock condenser, Thordarson O.T. and key, $18. Menominee Rotary Gap, $9. Both for $25. Duck 'Navy tuner, Murdock 21 and 43 condensers, home made control panel $15. Guaranteed. H. Oge, Boonville, Ind.

TELEPHONE AND MUSICAL CONCERTS with a Single Bulb. Are you satisfied with your receiving set? Would you like one that will receive 6,000 miles? Would you like to build a simple one and quit experimenting? One using parts you already have and that will be the equal of any regardless of claims or price? If so, get our simple diagram of a complete short and long wave receiver, 175 to 20,000 meters, with which we read Honolulu, California, South America, German, French and English stations, and practically all the high powered foreign and domestic stations, with a single bulb. Amateurs as far west as New Mexico and numerous telephone and musical concerts come in good. Diagram and complete instructions, leaving nothing to guess about will be promptly mailed for fifty cents in coin or stamps. Virginia Novelty Co., Martinsburg, West Va.

QRA de 8BVR, J Phillips, 9711 Lamont Ave., Cleveland, Ohio.

WHY PAY NAVY PRICES? Type CW 296, Navy price $450, our price $225. Telefunken set, complete transmitter and receiver, like new $250. Both are ½ KW 500 cycle quenched gap sets. Miscellaneous bargains 3KW "Coffin" $25. Leyden Jars .002 mfd. $1.25. Dubilier .004, new, $12.50. Marconi ten inch coil $18.00. Crocker,Wheeler motor generators 500 cycle ½ KW $75, with gasoline unit $100. Henry Kienzle, 501 E. 84 St., New York.

TRADE: CHI-RAD variometer set with a free subscription to QST for $10.00. Port Arthur Radio Laboratory. Port Arthur, Texas.

PRINTS for prize winning phone set at 2nd District Convention now obtainable for $3.75, showing all details for building. Mr. A. J. Bischoff, 326 Sussex Avenue, Newark, N. J.

FOR SALE: A sixteen unit 100-20,000 meter receiving cabinet, glass front, slide tuner, honeycomb coils and regenerative hookup, with three rheostats, five condensers, key, batteries, tubes, phones, etc., also spark coil. G. E. Smiley, Chicopee Falls, Mass.

BARGAINS: 4,000 R.P.M. ½ KW Rotary Gap $10. Short Wave Regenerative Set $10, Arlington Coupler $8.00. C.O.D. or cash. H. Webb, 18 Beach Ave., Milford, Conn.

FOR SALE: Three 5 watt Western Electric power tubes, $12 each. The Three for $35. Postpaid. Tubes have been used about twenty hours. Harry Leva, 817 Cherry St., Fort Worth, Texas.

1KW Quenched set only $75.—3US.

LOOK: Motor generator set, $35.00; 110V. A.C. to 420 D.C. consists of 1-6 H.P. Westinghouse and Robbins-Myers generator. Three 6 volt 60 amp. hr. Exide storage batteries, new plates, $11.50. Make offer for Amrad Gap, ½ KW and heavy O.T. Want W. E. Co. VT 2 bulbs. H. Witzler, Box 585, Ada, Ohio.

YES QSA VY 5XJ-5QS-5IR reach out. They use our Super DX equipment. Why not you? Let us help. Catalog 5c. Southern Radio Laboratory, Dublin, Texas.

BARGAINS: Variometer regenerative (C-E variometers), oak cabinet, $27. 1-step RF-detector, and 1-step AF, all on bakelite panel, oak cabinet, $23. New tubes, fones, B-Batteries extra, $25. Other bargains. The Radio Exchange, 9DBQ, Stroh, Indiana.

250 WIRELESS exam questions answered, in the "New License Quiz Book for Government First Class Examinations." First edition with Government's July 1st, 1921 rules, regulations, and gradings. Essential information on hook-ups, new devices, international laws, regulations, practical equations, diagrams, definitions—106 pages—over 80 illustrations and drawings. Every amateur candidate for license should have this book. Don't miss it! A dollar bill pinned to this ad and addressed to us brings it by return mail. Send for this "Operator's Bible" today. You can't do without it. Order Now! National Radio Institute, Dept 11-M, 1345 Pennsylvania Ave., N. W., Washington, D. C.

FOR SALE: 1KW Amrad Quenched Gap and resistance $21.00, Penn C. Oscillation Transformer $7.00; Penn C Regenerative Set $29.00; Baldwin Phones $10; Acme 150 Watt Filament Transformer $12; Audion Panel $5 Amplifier, one stage, $9.75; Radiolectric 2mfd. Filter Condenser $4.25; Acme 150 M.A. Filter coil, $4; Federal Hand Microphone $6.00; 43 plate Variable Condenser $3.50. Transportation charges prepaid. R. D. McCommon, 268 N. Market St., East Palestine, Ohio.

BKUMA YRLSBUG. Two hundred beginners tell how memorized Wireless Code in 30 minutes to two hours. Booklet 10 red stamps. Dodge, Box 210, Mamareneck, N. Y.

SELL: $25 drafting instruments for fifteen. R. Batdorf, R-3, Urbana, Ohio.

EDISON B Battery elements. Make your own. Can be recharged and lasts for years. Harry Morrell, 52 Goffe St., New Haven, Conn.

NEW SYNCHRONOUS MOTORS: $27.50 1-5 HP-220 volt 1800 R.P.M. Also ⅛ and ¼ H.P.-110 and 220 volt synchronous motors at very low prices. Stock limited—order at once. Stahl Rectifier Company, 1401 W. Jackson Blvd., Chicago, Ill.

CROSLEY V-T Socket 60c .0005 Condenser $1.25, with knob and dial $1.75, rheostats, switches, etc., low prices. Circulars free. Crosley Manufacturing Company, Dept. Q-7-C, Cincinnati, Ohio.

SELL: Complete Regenerator, Detector—two-step with bulbs, batteries and fones $85.00. E. H. O'Neill, 9DSG, Downer's Grove, Ill.

FOR SALE: Short wave Regenerative Receiver with one step complete $45. Baldwin phones $10. Murdock phones and Variable Condenser $5. 1 inch Spark Coil with key $5. Westinghouse Rectifier $15. E. Schuessler, 2209 Wheeler St., Cincinnati, Ohio.

POOR CONNECTIONS on storage batteries for radio or automobile prevented by using Battery Aid. Guaranteed. 25 cents box. 6 cents parcel post. The Tucker Elec. Co., Box 17, Tariffville, Conn.

SURPLUS STOCK SALE. Mounted Arco and Clapp-Eastham Amplifying Transformers, new $3.50 each. Paragon rheostats $1.25 each. Corwin Dials and Knob $1.20 prepaid. We have Chirad Variometers and Variocouplers $10, knockdown $14.00 assembled $20.00 in cabinet with Formica panel. This includes two variometers and one Variocoupler. Real apparatus and Real Service on all makes. Have you seen "Horatio," audion control panels? Detector $6.50, Amplifier $16.50. Hoopeston Radio Shop, Hoopeston, Illinois.

FOR SALE: One No. 5 Edifone. Will record or reproduce. $165 value for $85. Practically new. For full description write, V. Yann, 512 Catherine St., Syracuse, N. Y.

BARGAIN: 400 volt motor-generator 100 watts. Directly coupled and mounted on cast iron bed-plate, Motor ¼ HP Robbins & Meyers 1725 RPM, 42 segments on generator commutator $45.00. Two double filament Audiotrons $5 each. 0-10 amp G.R. Hot-wire Ammeter $6. Clapp-Eastham modulation transformer $3. Microphone $1. All in perfect condition and guaranteed. J. R. Dean, 86 Vermont St., Rochester, N. Y.

FOR SALE: Murdock Antenna Switch $3.00, Paragon Rheostat $1.00, Century Buzzer $1.25, ¼ Spark Coil and Gap $2.00, New VT Socket $0.75, DeForest Amplifying Transformer $4.50, Honey-Comb Coils and mounting 25% off list price, R. Combes, 268 Westfield Ave., Roselle Park, N. J.

SAVE MONEY on new Amrad and Grebe sets. Write: The Radio Shop, Winchester, Va.

FOR SALE: Two Hoyt 0-30 Ammeters $8.00 each. One set of American Technical Society's Cyclopedia of Drawing $10.00. One set of nine piece drawing, set $3.50. 8 vol. Hawkins Electrical Guides $0.65 each. All articles in A-1 condition. Y. Y. Watari, Alfalfa, La.

COMPLETE STATION CHEAP—1 KW Transformer Oil Condenser, Rotary, OT, Key, H.W.A. Aerial Switch, Audion Cabinet, Arnold Coupler, Stromberg Carlson's. All for $75. Will consider Baldwin or Browns. Write Paul Weniger, Cresco, Ia.

FOR SALE: Old 2RK's 1KW Coffin that broke world's amateur records, like new, 3 United Wireless jars for Coffin, $4 each. 1KW heavy duty key $2.50. Murdock OT $3.00, H.W.A. 0-5, $5.00, Marconi aerial switch $3.00. Radio 2RQ, 821 Argyle Road, Brooklyn, N. Y.

LIBERAL DISCOUNTS on all standard radio apparatus are given to wide awake amateurs who represent us. Write us for particulars immediately. Wilmington Electrical Specialty Company, 705 Adams Street, Wilmington, Del.

FOR SALE: One complete transmitter for spark. Has Thordarson 1KW type "R" transformer, Thordarson oil-immersed condenser, Thordarson OT, brand new Benwood "Sink" Gap and Navy type key. Address Herbert L. Gordon, Antwerp, Ohio, Radio 8BAS.

RADIO APPARATUS built to order. Send diagram and description for estimate. C. C. Pidgeon, 1343 Clifton St., N. W., Washington, D. C.

8AWP's entire spark set and parts of 100 watt CW set. 500 watt 25-60 cycle CW transformer $12. S. Woodworth, 425 Brownell St., Syracuse, N. Y.

WANTED: Your used apparatus for new goods. We have some splendid bargains in used apparatus. The Radio Exchange, 9DBQ, Stroh, Indiana.

HOW'S THIS? Stranded copper aerial wire, $3.75 per 500 ft. $7 per 1000 ft. Audion controls, Det. $5. Amplifier $9.50. We pay transportation on all of our tube controls anywhere in the United States. We carry a complete stock of the parts you need for that new set. Send for lists. Devore Radio Supply Co., Gibson City, Illinois.

SELLING OUT: Large assortment of radio apparatus to be sold at a sacrifice. All letters answered. Y. A. Golobe, 1248 St. John's Place, Brooklyn, N. Y.

AMRAD ½ Kilowatt quenched gap; Signal rotary motor; Complete rotary; Oscillation transformer; Key; Also good pair French binoculars. R U interested? 9AYK.

FOR SALE: Dubilier condenser .01 25000 V. 1000 watts $40.00; 1 KW Acme type H-1 $30.00. Enclosed spark thru gap $20.00; ½ KW Packard transformer $12.00; 4 Sections Murdock condenser $2.00, Paul Graeter, 967 E. McMillan St., Cincinnati, O.

FOR SALE: Complete short wave receiver including detector mounting; Wireless Mfg. Co. rotary spark gap; Radio Apparatus Co., long wave receiver complete. Prices and description on request. V. C. McIlvaine, Auburn, Ala.

HAVE :1 Autographic Kodak Special F 6.3 new. Want good Magnavox. Ralph Wood, Dewey Ave., Portsmouth, Ohio.

EXCHANGE: CHI-RAD variometer set with a free subscription to QST for $10.00. Port Arthur Radio Laboratory, Port Arthur, Texas.

Telephone and musical concerts. If you want to hear them get our simple diagram and hook up advertised this issue under classified advertisement. Virginia Novelty Company, Martinsburg, West Va.

FOR SALE: Grebe CR-8 set 4 stage amplifier, 100 ampere Marco battery, range 300 to 25000 meters. $300. 219 East 39 St., New York.

SACRIFICING 8BK's Spark Set. Spl Synk Rotary Quenched Gap with Motor, $45.00; 1KW Thor Trans, $20.00; 1KW Thor Condenser, $12.00; OT 2" Ribbon, $3.00. Other bargains. Best DX 1900 miles. Rad. 5.1 Thermo Amps. H. G. Squires, 2048 East 79th St., Cleveland, Ohio.

8AC call has been changed to 8BTO. CW on 200 meters. Please QSL via. card. A. L. Kent, 199 Court St., Binghamton, N. Y.

LIVE AMATEURS READ THIS 500 ft. No. 14 pure copper aerial wire $2.00; 500 ft. 7-22 stranded $3.50. Big stock of magnet wire 50c per lb. and up. Immediate shipments. Wilmington Electrical Specialty Company, 705 Adams Street, Wilmington, Delaware.

$25 TAKES extra new quarter horse synchronous motor. Adjustable arm easily applied. Other bargains. Send stamp for list. B. W. Stolte, 9NJ, 3554 S. Halsted Street, Chicago, Ill.

FULL LINE OF RADIO EQUIPMENT

of all leading manufacturers, Storage Batteries, Genuine double Filament Audiotrons $5.00

Ask for circular

Galveston Wireless Supply Company.
2006 Ave. B, Galveston, Texas

QST ? QRV ?

Let 5IF supply your radio apparatus. Large stock AMRAD equipment, aluminum for condenser plates, copper ribbon for oscillation transformers, transformers, condensers, rotary and quenched gaps, Grebe, AMRAD regenerative receivers, hot wire meters, phones, Moorhead detector and amplifier tubes, rheostats, switch points, etc. Transportation prepaid when half or more cash accompanies order. Shipment subject to stock on hand.
RADIO STATION 5IF, AMARILLO, TEXAS

PROMPT SHIPMENTS FROM

"DELFELCO"

DELANCEY FELCH & CO.
12 Meeting St., Pawtucket, R. I.

Branches:

Fall River, Mass. — 84 No. Main St.
Providence, R. I. — 6 Market Square

A GUARANTEED STORAGE BATTERY FOR $6.00

This battery is of very best construction thruout. New Batteries Manufactured by an Automobile Battery Co. Immediate delivery. Shipped fully charged.

6 Volt 30 Amp. Hour $6.00
6 Volt 60 Amp. Hour 12.00

TRY OUR SERVICE WHEN YOU ARE IN A HURRY—Westinghouse, Firco, Amrad, Kennedy, Murdock, Benwood, Magnavox, General Radio, Federal, equipment of quality.

CLARION RADIO SHOP
347 MAIN ST., POUGHKEEPSIE, N. Y.

Telephone and Telegraph
APPARATUS

The new C.W. Equipment of The Radio Corporation now in stock for immediate delivery. None better at any Price.

DEALERS—ATTENTION

The Price is right. Goods shipped same day order is received.

3XAB

Virginia Radio Co.
Charlottesville, Virginia.

The BEST in **RADIO**

CARDBOARD TUBING

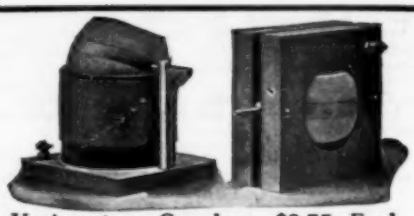
In any length up to 25".
3" and 3½" Diam. 3½ cents per inch or fraction—30 cents per foot; 4" and 4½" Dia. 4 cents per inch or fraction—35 cents per foot; 5" 4½ cents per inch or fraction—42 cents per foot. 3", 3½" and 4" has ⅛" wall; 4½" and 5" has ¼" wall. Postage extra. Shipping weight about 1½ lbs. per foot. **Dealers write for discounts. Circular for stamp.**

JEFFERY-CRAWFORD COMPANY
2173 Hillger Ave., Detroit, Mich.

——FORMICA PANELS——

Marked off, drilled, grained, buffed. Large holes cut for meters. Send drawing with exact dimensions for estimate. We guarantee quick service, accuracy and satisfaction.

RADIO PANEL SHOP
1103 S. Third St., Evansville, Ind.



Variometers Couplers, $3.75 Each
Wound but unassembled, $3.00 Each

These Instruments embody best workmanship and materials, all wooden parts genuine mahogany, coupler primary wound on Formica tubing. Wound to assure maximum results for short wave work. Shafts ¼ inch. With Chelsea Dial and Knob $1 extra. Send for bulletin describing panels, parts and other apparatus.

FREDERICK WINKLER, Jr.,
304 Columbus Ave., New York, N. Y.

MOST MILES PER DOLLAR

With ATLAS CW Radio Apparatus

Make your money talk to the tune of 15 miles per dollar. Money back guarantee.

1000 Miles			$70.00
PT-2 CW Trans.	$11.00	Inductance #1 ..	$5.00
2 Tube Sockets..	2.00	2 Tubes	16.00
1 Meter	8.00	1 Key	1.00
2 Variables	10.00	2 fixed cond's...	3.00
1 Double Choke..	5.00	2 Switches	2.00
2 Rheostats	4.00		
	$40.00		$30.00
			40.00
TOTAL			$70.00

Send ten cents for complete catalogue.

THE AMERICAN RADIO SALES AND SERVICE CO.
Mansfield, Ohio, U. S. A.

COMPARE THESE PRICES

Triple Honeycomb Mounting (for panel mounting)	$5.00
Variometer Wood Parts (Unassembled and unmounted	$2.00
Miniature D. P. D. T. Panel Switch	$1.00
Vario-Coupler Rotor	.60

Send 10c for Bulletin and future announcements

PARAGON ELECTRIC COMPANY
215 North 6th St., E. Newark, New Jersey

INVESTIGATE

Where Dependable Quality Is Low Priced

Literature sent immediately on
DX AMPLIFERS

DX RADIO COMPANY
Summit, Ill. Factory, Argo

Best of Everything in Radio Apparatus and Parts

Send Stamp for Catalog "Q"

J. H. BUNNELL & CO.
32 Park Place, New York

RADIO CONSTRUCTION CO.

Manufacturers of all kinds of Wireless Telephone and Telegraph apparatus. Panel drilling and engraving a specialty. Binding Posts, stops, switch points, nuts and screws of all sizes.

42 Maverick Square
Winthrop Block East Boston, Mass.

—FOR YOUR CONVENIENCE—

QST'S INDEX OF ADVERTISERS

IN THIS ISSUE

Acme Apparatus Co. 124
Adams-Morgan Co. 92
Ajax Electric Co. 130
All-American Electrical Mfrs. 118
American Radio&Research Corp. ..... Fourth Cover
American Radio Sales & Service Co., The 134
Andrae & Sons, Co., Julius 102
Apex Radio Shop 84
Atlantic-Pacific Radio Supplies Co. 87
Atlantic Radio Co. ..... Second Cover

Baldwin Radio Elec. Mfg. Co. 98
Bowman & Co., A. W. 122
Brandes, C. Inc. 74
Bunnell & Co., J. H. 134
Burgess Battery Co. 70

California Electric Supply Co. 95
Carter Electric Co. 112
Chelsea Radio Co. 93
Chicago Radio Apparatus Co., Inc. 86
Chicago Radio Laboratory 131
Clapp-Eastham Co. 89
Clarion Radio Shop 134
Classified Advertisements 132
Condensite Company of America 91
Connecticut Telphone & Elec. Co. ..... Third Cover
Consolidated Radio Call Book Co., Inc. 116
Continental Electric Co. 96
Continental Radio & Elect. Corp. 136
Corwin & Co., A. H. 118
Coto-Coil Co. 76
Craig & Loughborough 116
Crosley Mfg. Co. 103

Davis & Co., C. A. 118
DeForest Radio Tel. & Tel. Co. 74
Delancey, Felch & Co. 134
Devon Electric Co., Inc. 80
Diamond State Fibre Co. 102
Doubleday-Hill Electric Co. 68
Duck Co., The Wm. B. 109
DX Radio Co. 134

Eastern Radio Institute 99
Electrical Specialty Co. 125
European Radio Co. 108
Experimenters Information Service 72

Federal Specialty Co. 82
Federal Telephone & Telegraph Co. 128
Firth & Co., John 120
Formica Insulation Co., The 81
France Mfg. Co., The 86-110

Galveston Wireless Supply Co. 133
General Apparatus Co., Inc., The 85
General Radio Co. 83
Gordon, Heck & Co., Inc. 122
Grebe & Co., A. H., Inc. 97

Higee Radio Mfg. Co. 86
Hommel & Co., Ludwig 92
Hygrade Electrical Novelty Co. 112

Ideal Apparatus Co. 126
Independent Radio Supply Co. 106-114

J-Ray Mfg. Co. 120
Jeffery-Crawford Co. 134
Jewell Electrical Instrument Co. 114
Johnston, Chas. H. 122
Joy & Kelsey 98

Karlowa Radio Co., The 78
Kelly & Phillips 94
Kennedy Co., The Colin B. 114
Kimley Electric Co. 122
Klaus Radio Co. 110
Klosner Improved Apparatus Co. 111
Kuebler Radio Co., The 130

Laing, A. K., Radio Co. 88

Magnavox Co., The 126
Manhattan Elec. Supply Co., Inc. 4
Marshall-Gerken Co., The 115
Mass. Radio & Telegraph School, Inc. 124
McTighe Battery Co. 102
Metal Arts Co., Inc. 88
Meyberg Co., Leo J. 121
Missouri Radio Supply Co. 119
Moore, David L. 122
Mu-Rad Laboratories 82
Murdock Co., Wm. J. 71
Mutual Purchasers Assn. 96

Nash Electrical Service Co. 82
New England Radio Engineering Co. 116
Newman-Stern Co., The 120

Oklahoma Radio Shop 108

Pacent Electric Co., Inc. 2
Paragon Electric Co. 134
Parkin Mfg. Co. 100
Paquin, J. M. 120
Penn Print Shop 116
Peoria Radio Sales Co. 110
Philadelphia School of Wireless Tel. 90
Pioneer Electric Co. 112
Pitts Co., Inc., F. D. 105
Pittsburgh Radio & Appliance Co., Inc. 104
Precision Equipment Co., Inc., The 90

Radio Audion Co. 1
Radio Construction Co. 134
Radio Corporation of America 107
Radio Development Corp. 79
Radio Equipment Co., (Boston) 88
Radio Equipment & Mfg. Co. 108
Radio Exchange, The 130
Radio Instrument Co. 70
Radiolectric Shop Company, The 117
Radio Panel Shop 134
Radio Service Laboratories, Inc. 106
Radio Specialty Co. 127
Radio Station 5IF 133
Radio Testing Station 106
Ray-Di-Co. Organization, The 94
Remler Radio Mfg. Co. 3
Reynolds Radio Co., Inc. 118
Rhamstine, J. Thos. 130
Robertson Clock & Instrument Co. 84
Rose Radio Supply 94

Scientific Experimenter, Ltd. 92
Second Dist. Convention & Radio Show 100
Service Radio Equipment 96
Ship Owners Radio Service, Inc. 128
Shotton Radio Mfg. Co., The 130
Signal Electric Mfg. Co. 73
Simplex Radio Co. 104
Somerville Radio Laboratory 80
Southern Radio Supply Co. 110
Southwest Radio Supply Co., The 84
Standard Assembling Co. 76
Sterling Electric Co. 100

Telephone Maintenance Co. 113
Terrell, M. B. 76
Third and Fourth Dist. Convention 69
Thordarson Elec. Mfg. Co. 77
Tresco 80
Tri-State Radio Mfg. & Supply Co., The 78
Tufts, W. & G. 118
Tuska Co., The C. D. 98

U. of I. Supply Store, The 88

Virginia Novelty Co. 120
Virginia Radio Co. 134

Washington Radio Laboratory 130
Western Radio Electric Co. 104
Westinghouse Elec. & Mfg. Co. 101
Weston Elec. Instrument Co. 129
Winkler, Frederick, jr. 134
Wireless Mfg. Co. 123
Wireless Press, Inc. 90

Y. M. C. A. Radio School 72

ALWAYS MENTION Q S T WHEN WRITING TO ADVERTISERS

CONTINENTAL NEWS

January, 1922

PUBLISHED OCCASIONALLY IN QST BY THE CONTINENTAL RADIO AND ELECTRIC CORPORATION

PARAGON

R. A. TEN

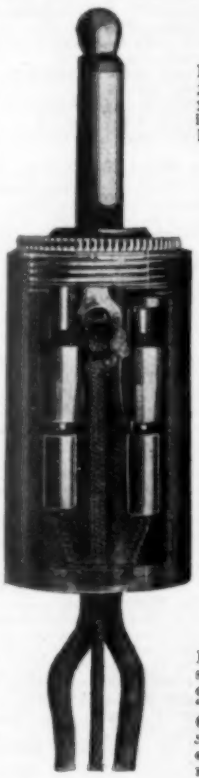
unexcelled for C. W. reception:

AS 2ZL recently wrote, "The Paragon is especially satisfactory in C. W. work, because of the entire absence of capacity effect." To receive the numerous wireless telephone broadcasting stations, you can do no better than invest in a genuine Paragon R. A. Ten. For, as 2ZM, 2ZL, and hundreds of other prominent amateurs have found, Paragon brings in the human voice with all its clear, natural qualities unimpaired. And the exceptionally sharp tuning you achieve eliminates a large part of the unpleasant QRM in the midst of a concert. Incidentally, the recent price reduction from $85.00 to $69.50—a clear saving of $15.50—makes Paragon today a better buy than ever before. Call or write for descriptive booklet.

Genuine Paragons are also on exhibition at

Ray-Di-Co.
1547 N. Wells St.
Chicago.

The Benwood Co.
13th & Olive Sts.,
St. Louis.



RADIO PLUGS

Be up-to-date! Equip your set with plugs and jacks throughout. Besides using plugs for your telephone head-sets, loud speakers, loading coil, microphone transmitter, transmitting keys, etc., score of other uses will be found by the ingenious amateur. The three makes of plugs shown here, all designed specifically for radio work, are a great improvement over the ordinary telephone switchboard plug. They fit all standard jacks. Order today from our liberal stock of each make.

FIRCO "Bull-Dog-Grip" PLUGS
Slight pressure on chucks instantly releases telephone cord tips. No soldering, instantly interchangeable, and "The harder you pull the tighter it grips."

Round Type.....$2.50 each
Flat Type.....$2.00 each

FEDERAL PLUGS
Made of Bakelite and designed to hold any type of conductor without soldering.

Price .....$1.75 each

PACENT Universal PLUGS
Accommodates all telephone cord tips and similar solid conductors. Sure contacts—no soldering.

Price .....$2.00 each

Above—New Federal Plug

Left — Cross-section view of FIRCO "Bull - Dog - Grip" interchangeable telephone plug, round type.

Right – Pacent universal Plug

When you build your Vacuum Tube sets you can save enough by using Creco Amplifying Transformers to pay for another step of amplification. Creco Transformers were purposely designed to meet the requirements of present day VTs. Hundreds of users have found that their simplicity and electrical efficiency result in unequalled audibility and amplification. The price complete ready for mounting is only $3.25 each. Such a good instrument should interest you at any price; but at this rock bottom price level Creco Transformers are by far the best buy on the market. Order at once to make sure of delivery.

Immediate shipments by mail of all apparatus shown here. Catalogue 25 cents—Address Dept. B-1

CONTINENTAL RADIO AND ELECT. CORP. 6 Warren St., N. Y.

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

CONNECTICUT RADIO

THE

NEW ELECTRON TUBE

For Radio Detection

The interest shown by the radio world in the new CONNECTICUT Electron Tube so far exceeded our expectations that it became necessary for us to arrange for production on a much larger scale than originally planned. This has meant unavoidable delay in deliveries.

We have taken advantage of the delay, however, to make certain modifications in the operating design of the Detector assembly. The principle of the tube and its sensitiveness remain unchanged; but the new assembly will enable even the less skillful operators to obtain superior results.

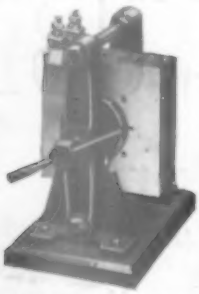
The delay will therefore work to the benefit of users of the CONNECTICUT Tube. Watch for announcement of delivery dates in the next issue of QST.

CONNECTICUT TELEPHONE & ELECTRIC COMPANY
Meriden Connecticut

AMRAD

The Recognized Symbol of Superior Performance

Induction Coil, 100 watt 6 or 32 Volt—$17.50



¼ KW Quenched Gap $10 Coil and Gap Combination Special Price $22.75

Synchronous Motor $25.00 1800 r.p.m. ¼ h-p. frame

LEADERS

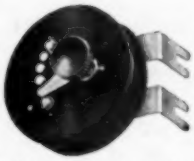
INVESTIGATE these leading Amrad Radio Products at your nearest Dealer's. If he does not stock, he will get them for you quickly and save you Time and Money.

The new Amrad Variometers and Vario-Couplers, (exclusive Amrad basket-weave) the Verniers, and other popular parts for the operator who builds his own, could not be crowded into this small space. See them at your Dealer's. Or write us for descriptive literature.

The new "S" Tube—THE TUBE WITHOUT A FILAMENT—will soon be on the market as a Rectifier. The first month's production is already sold. You should IMMEDIATELY place your order with your Dealer to assure delivery.

For those desiring high class, efficient Receiving Units, at a reasonable price, nothing excels the Amrad Short Wave Tuners and Detector-Amplifiers described in Bulletin L-1. These are COMPLETE—in solid mahogany cabinets—the height of Amrad engineering.

Order from Your Dealer only. Bulletins describing any product illustrated mailed FREE. Send 10c in stamps for Complete Catalog.



Adjustable Load Coil $3.85 For wavelengths to 3000 meters

Fixed Condenser $0.45 Seven Capacities, .0001 to .002 mfd.

Grid Leak $0.65 Six Values, ½ to 5 megohms Fits any Standard Mounting

Ampliformer, 2620, $6.00 Unmounted type, 2223, $3.75

AMERICAN RADIO AND RESEARCH CORPORATION

205 College Avenue
MEDFORD HILLSIDE, MASS.

New York District Office
13 PARK ROW

Chicago District Office
602 SO. DEARBORN ST.